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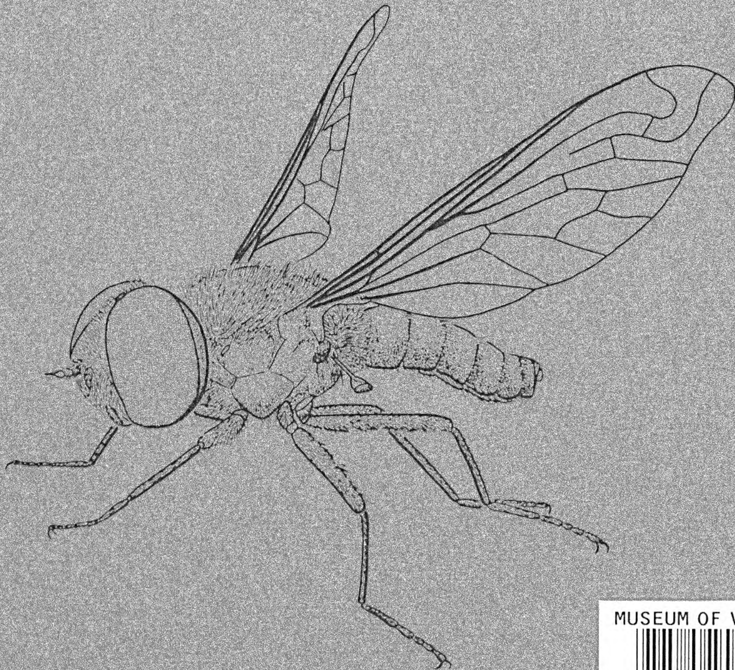

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Cover: This undescribed species of Bombyliidae of the genus *Docidomyia* is from the Goldfields Region of Western Australia. The genus belongs to the subfamily Tomomyzinae, and has closest relatives in southern Africa and North America. Adults feed on nectar and pollen and the larvae are presumably parasitoids, as are most other Bombyliidae, although nothing is known of the life history of this subfamily throughout the world. Illustration by David Yeates.

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APPARENT SITE AFFINITY IN *SCELIO PARVICORNIS* DODD AND *SCELIO IMPROCERUS* DODD (HYMENOPTERA: SCELIONIDAE) IN PASTURES INFESTED WITH *PHAULACRIDIUM VITTATUM* (SJÖSTEDT) (ORTHOPTERA: ACRIDIDAE)

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Abstract

The abundance of adult *Scelio parvicornis* and *S. improcerus* in a pasture site in the Southern Tablelands of New South Wales exhibited stable spatial variation commensurate with site affinity. Both species were abundant on an uncultivated, lightly timbered granite knoll supporting native grasses and introduced broad leaved weeds but virtually absent in extensive improved pasture skirting the knoll. The cause of the site affinity is unknown but was possibly associated with biotic factors such as a seasonally stable host population and reduced competition from other parasitoids. The site affinity was also coincident with the habitat of *Phaulacridium vittatum* in climax savanna woodland pre-european settlement and may represent an anachronistic, instinctual habitat preference. Although parasitism by scelionids was secondary to that of mermithid nematodes in influencing host population trends at all sites, the supplementary parasitism by scelionids could be important in habitats less favourable for mermithid nematodes. An inverse density dependence was apparent which could result in localised host extinction, extending the duration of the recessionary phase of the host outbreak cycle so limiting the frequency of grasshopper outbreaks.

Introduction

The role of scelionid egg parasites in the population dynamics of wingless grasshopper, *Phaulacridium vittatum* (Sjöstedt), has been little studied in tableland regions: Clark (1967) found a *Scelio* sp. at levels of <20% in the Canberra-Yass district at the end of an outbreak and Baker *et al.* (in press) recorded *Scelio* spp. at a mean parasitism rate of 33.5 % in tableland districts, also at the end of an outbreak. The relative abundance of scelionid species has been assessed by sweep net catches made during an outbreak of *P. vittatum* (Baker *et al.* 1985) and the generally low abundance of species parasitic on *P. vittatum* suggested a minor role in the population dynamics of this host. However they may have a more important role in the population dynamics of other acridid species in the tablelands (Baker *et al.* 1985, Baker and Dysart 1992, Baker and Pigott 1993). Factors such as parasitism by mermithid nematodes (Baker and Capinera 1995) and reduced oviposition under dry conditions (Baker *et al.* 1993) are generally considered of greater significance than scelionids in influencing the population dynamics of *P. vittatum*.

The observations reported in this paper were made during a long term study of the population dynamics of *P. vittatum* in tableland districts of New South Wales.

Methods

Sampling of fixed sites in pastures in the Southern Tablelands was undertaken

at irregular intervals throughout the season (October-April) between 1989-90 and 1994-95 seasons. The data presented in this paper are from site #14, 10 km south of Captains Flat [36°41'S, 149°27'E] at 1050 m in the Southern Tablelands of New South Wales. The site consisted of an elevated saddle connecting the main range with a granite knoll. The knoll was covered in decomposing, exposed granite tors and lightly timbered (Figs 1-2) with unimproved vegetation (Fig 3) consisting of introduced broad leaved weeds: Lamb's tongue *Plantago lanceolata* L., sorrel *Rumex acetosella* L., Aaron's rod *Verbascum thapsus* L., native tussock grasses (*Stipa* spp.) and the naturalised grass, rat tail fescue *Vulpa bromoides* (L.) S.F. Gray. Skirting the knoll was improved pasture (Figs 1-2) following cultivation in the 1987/88 season and planted to white clover *Trifolium repens* L. and perennial rye grass *Lolium perenne* L. (Fig 4). Samples were taken by making 120 low sweeps with a 45 cm net. Acridids were scored for species and stage and then dissected to determine parasitism. Acridid density was calculated from a prior calibration of sweep net efficiency. Three sub-samples were taken: 1, in uncultivated areas associated with granite knoll, 2, mid-slope of improved pasture, 3, lower-slope of improved pasture.

Results

Site affinity: Scelionids were first collected in the 1992-93 season and were restricted to site 1. In the 1993-94 season there was a substantial increase in abundance (>15 in 120 sweeps: Fig 5) which was again largely restricted to site 1. On all four of the six sampling occasions when scelionids were recorded, they were significantly more abundant at site 1 than all other sites ($F_{2,15}$ = 22.6, P <0.001). Scelionids were virtually absent from adjacent improved pasture. In the 1994-95 season there was a sharp decline in abundance (Fig. 5).

Three species were recorded, *Scelio parvicornis* Dodd, *S. improcerus* Dodd and *S. bipartitus* Kieffer. The former two species are parasites of *P. vittatum* and the latter of *Gastrimargus musicus* (F.). *S. improcerus* predominated throughout the 1993-94 season (Table 1) but was equal in abundance with *S. parvicornis* in the 1992-93 and 1994-95 seasons.

Phenology: In the 1993-94 season the abundance of scelionids peaked rapidly in early summer (December) when the host was at the 5th instar stage, i.e. some 5-6 weeks after hatching of the host. Abundance slowly declined over mid-late summer (January-February) and rose again in early autumn (March)

Figs 1-4. Grasshopper sampling site (Jerangle #14): an elevated saddle and granite knoll. 1, 1992-93 season (17.xii.1992) a season of above average spring rainfall (site 1, adjacent to knoll, site 2 in vicinity of granite slab (arrowed), site 3 in foreground). 2, 1993-94 (14.i.1994) a season of below average spring and summer rainfall. 3, native vegetation (site 1, 14.i.1994). 4, improved pasture (site 2, 17.xi.1993).

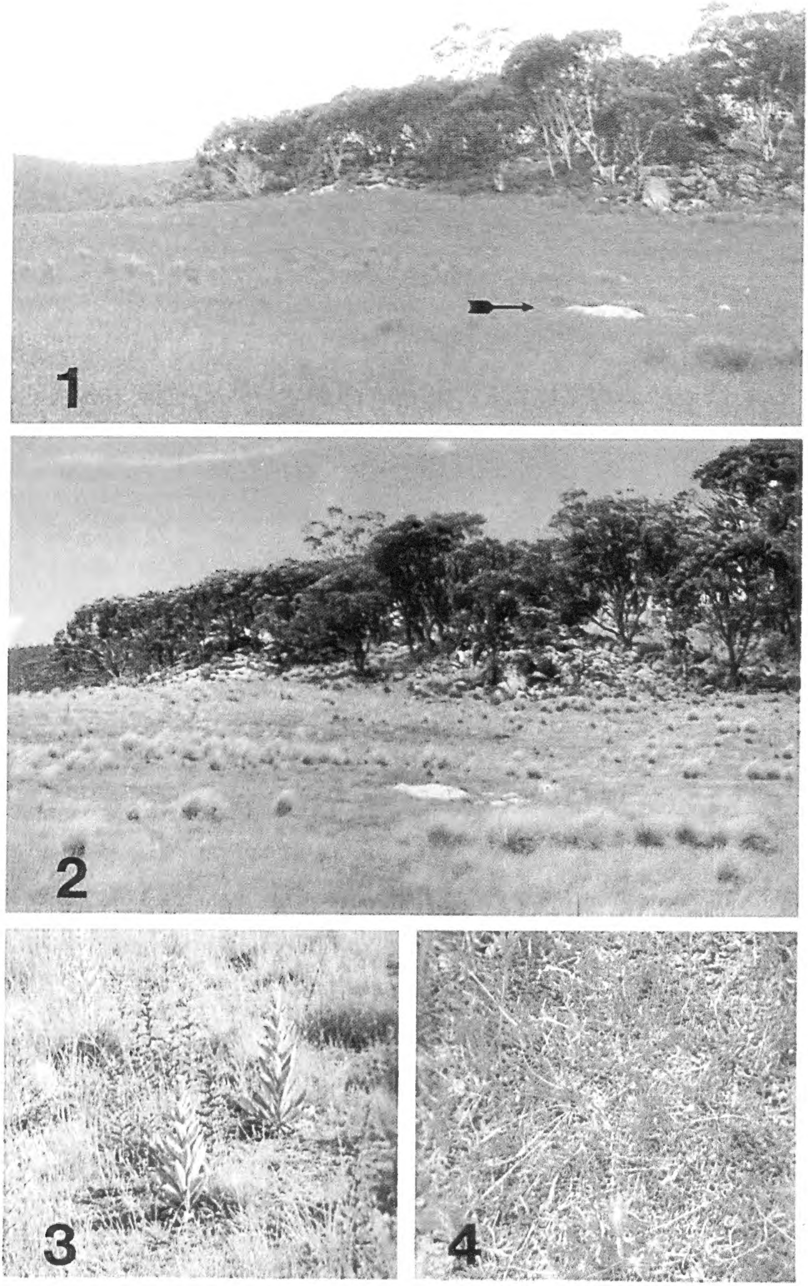

Table 1. The relative abundance of scelionids in the 1993-94 season in unimproved pasture (site 1) and improved pasture (sites 2-3) in the southern tablelands of New South Wales.

Species	Sex	Site*		
		1	2	3
S. parvicornis	M	18	0	0
	F	5	0	0
S. improcerus	M	30	1	0
	F	14	1	0
S. bipartitus	M	9	0	1
	F	2	0	0
Total/sex	M	57	1	1
	F	21	1	0
Total		78	2	1

*Number in 12 x 120 sweep samples (2 on each of 6 sampling occasions).

Table 2. The phenology of scelionids in 1993-94 season in the southern tablelands of New South Wales.

Species	Sex	Month*						Total	
		Nov	Dec	Jan	Feb	Mar			
						10	30	T	GT
S. parvicornis	M	0	13	5	0	0	0	18	
	F	0	4	1	0	0	0	5	23
S. improcerus	M	0	20	5	3	0	3	31	
	F	0	0	5	4	0	6	15	46
S. bipartitus	M	0	1	6	1	0	2	10	
	F	0	0	1	0	0	1	2	12
TOTAL		0	38	23	8	0	12		81

*Number swept in 6x10 sweep samples (2 at each site)

(Fig 5). Males predominated at all sampling occasions (Table 2) possibly because males searching for a mate are more vulnerable to capture than females which are possibly restricted to the litter zone in the search for host egg pods. The persistence of scelionids throughout the season was unexpected and may have been in response to a delay in the onset of oviposition by the host, a consequence of the relatively dry conditions in the 1993-94 season. The increase in early autumn was due to the emergence of the non-diapause component of the population.

Seasonal abundance in relation to rainfall and host density: Scelionids were first recorded in 1992-93, the second season of high rainfall and increased substantially in the 1993-94 season which received below average rainfall and declined in the 1994-95 season, also initially a season of low rainfall (Fig. 5). As their high abundance in the 1993-94 season was predetermined by conditions in the previous season, high rainfall was coincident with their initial increase in abundance but no direct causal relationship is proposed. A decline in abundance in the 1994-95 season followed dry conditions in the previous season.

The density of *P. vittatum* was highly variable throughout the study period (Fig 5). The highest densities occurred in the 1991-92 and 1994-95 seasons, the result of high survival in prior seasons (1990-91 and 1993-94 respectively) due on both occasions to low nematode parasitism under the relatively dry conditions (Fig. 5). The decline in the abundance of *P. vittatum* between the 1991-92 and 1993-94 seasons was associated with high levels of parasitism by mermithid nematodes due to high rainfall in both the 1991-92 and 1992-93 seasons (Fig. 5). The poor survival of *P. vittatum* during the 1994-95 season is also attributed to parasitism by nematodes following high rainfall in October and January (Fig. 5). The increase in absolute abundance of scelionids over the period 1991-1994 was coincident with a nematode induced decline in host density indicating inverse host density dependence. The decline in the abundance of scelionids in the 1994-95 season corresponded with a general increase in host abundance, but perhaps significantly not at site 1 where scelionids had been most abundant in the previous season.

The level of mortality of overwintering eggs due to parasitism by scelionids was not measured in the 1993-94 season, however, nymphal survival was high (Fig 5: November-December) and, reservedly assuming an equal capture efficiency, the ratio of scelionids to *P. vittatum* nymphs at the time of peak emergence of the scelionids can be taken as the ratio of grasshopper eggs parasitised by scelionids. This provides crude estimates of parasitism at site 1 of 3.6 % in the 1992-93 season (2 scelionids + 53 nymphs), 29.7 % in the 1993-94 season (14 scelionids + 33 nymphs), nil parasitism at mid and lower-slopes in 1992-93 and 1.3 % in the 1993-94 season (1 scelionid + 75 nymphs). These are gross underestimates of the level of parasitism as they

fail to take into account the staggered emergence of quiescent adults. The sharp increase in the estimated parasitism level in the unimproved pasture between the 1992-93 and 1993-94 seasons was coincident with a decline in host density indicating a possible inverse host density dependent relationship between parasitism level and host density. In the 1994-95 season, parasitism of overwintering eggs collected at site 1 and incubated in the laboratory was 36.36 %. This parasitism may have contributed to the low abundance of *P. vittatum* at site 1 in the 1994-95 season relative to sites 2 and 3 where substantial increases occurred (Fig. 5).

Discussion

Site affinity: the cause of the site affinity displayed by *S. parvicornis* and *S. improcerus* is unknown but is most probably in response to physical characteristics, host population stability or an instinctive habitat preference.

There were many physical characteristics which differed between unimproved and improved pasture which may explain the disparate abundance of scelionids in the two habitats: 1, cultivation and fertiliser applications to the improved pasture site may have rendered it physically or chemically unattractive; 2, numerous bare patches in the unimproved pasture (Fig 3) possibly increased the efficiency of finding host eggs, whereas in the improved pasture potentially bare patches were colonised by *T. repens* (Fig 4); 3, unimproved pasture may contain endemic potential food sources for adult scelionids which are absent from the improved pasture where exotic vegetation predominated; 4, the leaf litter on the fringe of the timbered site may provide shelter for adult scelionids.

There are also site differences in the temporal stability of host populations which impact on the abundance of scelionids. The relative instability of *P. vittatum* populations in improved pasture is a consequence of periodic pasture rejuvenation, variable grazing pressure under the influence of stocking rates and weather conditions and high levels of parasitism by mermithid nematodes. Cultivation to regenerate pasture results in emigration from the cultivated area by *P. vittatum* and the lack of hosts could lead to localised extinction of scelionids in the area cultivated.

Also contributing to the relative stability of *P. vittatum* populations at the unimproved pasture site is the relatively reduced effectiveness of mermithid nematode parasites (*Hexamermis* sp., *Amphimermis acridiorum* Baker & Poinar and *Amphimermis mirabinda* Baker & Poinar), most apparent in the 1991-92 and 1992-93 seasons (Fig. 5), due to high run-off lowering effective rainfall (Fig. 1). At mid and lower-slope sites a seasonally variable impact by mermithid nematodes on *P. vittatum* populations results in fluctuating host densities which may also adversely affect scelionid abundance.

The habitat preference may also have a behavioural basis unrelated to contemporary environmental or biotic characteristics of the habitat. Clark

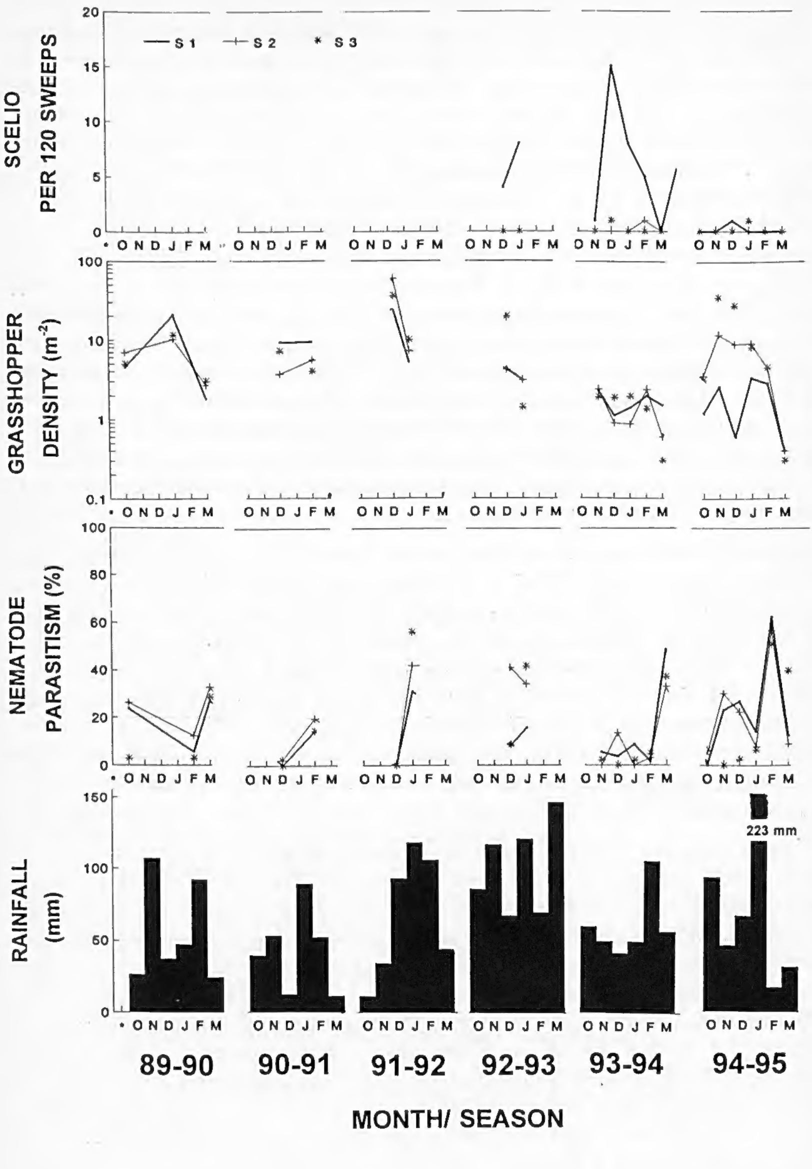

Fig. 5. Seasonal changes (October-March) in the abundance of *Scelio* spp. at three sites in relation to host density, rainfall and parasitism by mermithid nematodes.

(1962) reported that *P. vittatum* preferentially dispersed towards tall trees and postulated that this was a survival strategy encouraging movement towards favourable habitats (= prevented dispersal into unfavourable habitats). Clark (1962) suggested that the preferred habitat of *P. vittatum* in the original climax savanna woodland of tableland regions was the short vegetation on the fringe of woodlands. This is essentially the same habitat shown in this study to be favoured by both *S. parvicornis* and *S. improcerus*. Clark (1962) further suggested that the recent creation of short improved pastures in areas previously dominated by tall native species such as *Themeda australis* (R. Br.) Stapf., had increased both the distribution and abundance of *P. vittatum*. This study has shown scelionids to be virtually absent from improved pastures and their contemporary distribution is possibly an anachronistic, instinctive habitat preference based on the former restricted distribution of their host. The failure of scelionids to adapt to the wider distribution achieved by *P. vittatum* with the replacement of native vegetation by improved pasture during post-european settlement, perhaps indicates habitat selection by a different set of environmental cues, cues unsatisfied for scelionids in the wider contemporary distribution of the host.

The relative success of mermithids under contemporary land-use patterns in the tablelands indicates that, in contrast to scelionids, they either spread simultaneously with *P. vittatum* and are co-adapted to the improved pasture environment or, subsequent to the spread by *P. vittatum*, adapted to *P. vittatum* from alternative grasshopper hosts in the *T. australis* grasslands. The later scenario is the most probable given the habitat preferences of mermithid parasites of acridids (Baker and Capinera 1995) and the former abundance of the alternative host *Gastrimargus musicus* (F.) in *T. australis* grasslands prior to the establishment of pastures and its displacement by *P. vittatum* (Key 1959).

Seasonal abundance: The increase in abundance of scelionids towards the end of the study period was associated with several seasons of above average rainfall and a decline in host density. Although rainfall can not be dismissed as a factor influencing the abundance of scelionids, it is here assumed the influence is indirect through its influence on host abundance. The inverse density dependent relationship between scelionid abundance and host density apparent in this study is at variance with the findings of Putnam (1953) and Farrow (1977) that the absolute abundance of scelionids is host density dependent. The relative abundance of scelionids and host nymphs in this study indicate elevated parasitism levels also associated with declining host density. Clark (1967) reports a host population increase between 1957 and 1959 coincident with a decline in the abundance of an unidentified scelionid from 20.9% to 11.3%. Although the decline is not substantial, it also indicates an inverse density dependence in parasitism level.

Although of restricted distribution, scelionids in the 1993-94 season reduced

the productivity of the host population to that of replacement only, whereas in their absence and under climatic conditions unfavourable for other biocontrol agents, there was a 10-15 fold increase in host density.

The inverse density dependence exhibited by scelionids at the unimproved pasture site does not necessarily mean they have an unimportant role in the population dynamics of *P. vittatum*; the suppression of the host when at low densities could result in a more protracted recessionary phase in the outbreak cycle than would otherwise be the case, perhaps substantially reducing the frequency of outbreaks.

Although the level of control exerted on the host population by scelionids at "hot-spots" is insufficient to prevent seasonal carry-over of *P. vittatum* populations, it may, at times, be sufficient to inhibit emigration and the development of secondary infestations. The level of control may also be sufficient to maintain host densities below the threshold density for the production of macropterous morphs so reducing the substantial contribution (Farrow *et al.* 1982) made by winged females to the initiation and spread of regional outbreaks.

Acknowledgments

We wish to thank R. Farrow, CSIRO, Canberra, for critical reading of the manuscript, A. Austin, University of Adelaide for confirming the identity of voucher specimens of scelionids, A. Clift, NSW Agriculture, Rydalmere for statistical analysis of scelionid distribution data and C. Carlson, "Mirrabinda", Jingera for providing rainfall data.

References

BAKER, G.L. and CAPINERA, J.L. 1995. Nematodes and Nematomorphs as control agents of grasshoppers and locusts. *In* Goettel, M. and Johnson, D. (eds.), *Microbial control of grasshoppers and locusts.* Canadian Entomological Society, Ottawa:

BAKER, G.L., COILPARAMPIL, R., MAYERS, W. and PARKER, W.F. 1993. The population dynamics of wingless grasshopper, *Phaulacridium vittatum* (Sjöstedt), on the South West Slopes of New South Wales. *In* Prestige, R. (ed.), *Proceedings of the 6th Australasian Conference on Grassland Invertebrate Ecology.* Agresearch, Hamilton: 20-26.

BAKER, G.L. and DYSART, R.J. 1992. Development of *Scelio bipartitus* Kieffer (Hymenoptera: Scelionidae) in diapause eggs of *Gastrimargus musicus* (F.) (Orthoptera: Acrididae). *Journal of the Australian Entomological Society* **31:** 241-242.

BAKER, G.L., DYSART, R.J. and PIGOTT, R.G. *in press.* Parasitism of grasshopper and locust eggs (Orthoptera: Acrididae) by *Scelio* spp. (Hymenoptera: Scelionidae) in southern Australia.

BAKER, G.L. and PIGOTT, R.G. 1993. Parasitism of *Chortoicetes terminifera* (Walker) (Orthoptera: Acrididae) eggs by *Scelio parvicornis* Dodd (Hymenoptera: Scelionidae). *Journal of the Australian Entomological Society* **32:** 121-126.

BAKER, G.L., PIGOTT, R. and GALLOWAY, I. 1985. The phenology of *Scelio* spp. (Hymenoptera: Scelionidae), parasites of acridid eggs (Orthoptera: Acrididae) in South East Australia. *In* Chapman, R.B. (ed.), *Proceedings 4th Australasian Conference on Grassland*

Invertebrate Ecology. Caxton Press, Christchurch: 268-275.

CLARK, D.P. 1962. An analysis of dispersal and movement in *Phaulacridium vittatum* (Sjöst.) (Acrididae). *Australian Journal of Zoology* **10:** 382-399.

CLARK, D.P. 1967. A population study of *Phaulacridium vittatum* Sjöst. (Acrididae). *Australian Journal of Zoology* **19**: 799-872.

FARROW, R.A. 1977. Origin and decline of the 1973 plague locust outbreak in Central Western New South Wales. *Australian Journal of Zoology* **25:** 455-489.

FARROW, R.A., NICOLAS, G. and DOWSE, J.E. 1982. Migration of the macropterous form of the wingless grasshopper, *Phaulacridium vittatum* (Sjöstedt) during an outbreak. *Journal of the Australian Entomological Society* **21**: 307-308.

KEY, K.H.L. 1959. The ecology and biogeography of Australian grasshoppers and locusts. *In* Keast, A., Crocker, A.L. and Christian, C.S. (eds.), *Biogeography and Ecology in Australia.* W. Junk, The Hague : 192-210.

PUTNAM, L.G. 1953. Observations on internal parasites of eggs of pest grasshopper species in the prairie provinces of Canada. *Canadian Entomologist* **85:** 255-260.

PSOCOPTERA FROM THE CYCAD *LEPIDOZAMIA PEROFFSKAYANA* REGEL (CYCADACEAE) IN NEW SOUTH WALES

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Abstract

Nine species of Psocoptera are recorded from the cycad *Lepidozamia peroffskayana* Regel.

Introduction

This note records 9 species of Psocoptera on the cycad *Lepidozamia peroffskayana*, made during an ecological survey at Lorien, Lansdowne, near Taree by G. and T. Williams. Clarry Chadwick will be reporting elsewhere on Psocoptera from another cycad, *Macrozamia communis* L. Johnson.

Psocoptera from *Lepidozamia peroffskayana*

CAECILIIDAE

Caecilius quercus Edwards. 1♂, 4♀♀, 7 nymphs, beaten from frond in wet sclerophyll habitat (mainly fronds not dead), 29.v.1981.

Paracaecilius lemuris Smithers. 3♀♀, beaten from fresh fronds in wet sclerophyll/rainforest interface, 29.v.1981.

AMPHIPSOCIDAE

Taeniostigma trickettae Smithers. 2♂♂, 2♀♀, 2 nymphs, beaten from fresh frond in wet sclerophyll/rainforest interface, 6.vi.1981; 2♂♂, 2♀♀, 12.vi.1981; 1♂, 2♀♀, 5 nymphs, 24.v.1981.

ECTOPSOCIDAE

Ectopsocus australis Schmidt & Thornton. 1♀, 24.v.1981; 2♂♂, 2♀♀, 12.vi.1981.

PERIPSOCIDAE

Peripsocus milleri (Tillyard). 1♂, 1♀, 12.vi.1981.

PSEUDOCAECILIIDAE

Lobocaecilius monicus Lee & Thornton. 1♂, 1♀, 24.v.1981.

Pseudoscottiella rotundata New. 1♂, 1♀, beaten from fresh fronds in wet sclerophyll/rainforest interface, 6.vi.1981; 1♂, 12.vi.1981.

PSOCIDAE

Sigmatoneura formosa (Banks). 1♂, beaten from fresh frond in wet sclerophyll forest, 12.vi.1981.

Clematostigma maculiceps (Enderlain). 1♂, beaten from fresh frond in wet scleophyll forest, 12.vi.1981.

Discussion

All species so far taken from the cycads are known also from other plants. *C. quercus, P. lemuris, L. monicus* and *P. rotundata* are mainly inhabitants of fresh foliage, *T. trickettae* lives in a similar situation in rain forests whereas *E. australis* lives in dead leaves. *P. milleri, S. formosa and C. maculiceps* have been collected from bark.

Acknowledgments

I would like to thank Geoff and Thusnelda Williams for the opportunity to study their material and for depositing it in the Australian Museum.

RANGE EXTENSIONS AND DISTRIBUTION RECORDS FOR SOME BUTTERFLIES IN NORTH-EASTERN QUEENSLAND - PART IV

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Abstract
New distribution records and range extensions in north-eastern Queensland are given for *Netrocoryne repanda* C. & R. Felder, *Trapezites symmomus* Hübner, *Hesperilla ornata* (Leach), *Acrodipsas brisbanensis* (Miskin), *Hypochrysops delicia* Hewitson, *Ogyris genoveva* Hewitson, *Hypolycaena danis* C. & R. Felder and *Ionolyce helicon* (Felder). Comments on subspecific status are made for some taxa.

Introduction

Recent collecting in Queensland, particularly the Eungella area west of Mackay, has produced the following new records which concludes a series of papers dealing with butterfly distributions in north-eastern Queensland (Braby and Dunn 1991, Braby 1992, 1994). The records provide localities of distributional interest and extensions to the known ranges of eight butterfly species in the families Hesperiidae and Lycaenidae. Of particular interest is the first reliable record of *Ogyris genoveva* from north-eastern Queensland. Nomenclature follows Common and Waterhouse (1981).

HESPERIIDAE

Netrocoryne repanda C. & R. Felder

One female was captured in upland rainforest in the Bluewater State Forest, approximately 35 km W of Bluewater near Townsville, on 30.xi.1992. Two fresh males were also netted hilltopping in open-forest on the summit of St. Johns Peak (920 m), about 14 km S of Eungella on 13.iii.1994. The female has the terminal and subterminal region of both wings fairly dark, especially on the underside of the hindwing, and the yellow streak between the cell spot and costa on the forewing extends proximally beyond the cell spot, although the streak is not longer than the cell spot, unlike *N. r. expansa* Waterhouse females. The two males are dark brown on the upperside and underside but they lack the pale yellow streak between the cell spot and costa, a feature which differentiates *N. r. expansa* males (Common and Waterhouse 1981). Examination of specimens in the ANIC indicated that the difference between the two recognised subspecies is very minor, especially among females. Dunn and Dunn (1991) also showed that the distribution limits of these two subspecies were difficult to define: *N. r. expansa* reaches its southern limit at Mission Beach (Wilson 1984), while *N. r. repanda* appears to reach its northern limit at Airlie Beach with a possible record from Townsville. The specimen from the Bluewater Range confirms the existance of the species near Townsville and provides a new intervening locality. Further material is needed between Mission Beach and the Mackay-Eungella area to clarify the status of the two currently recognised subspecies.

Trapezites symmomus Hübner

Three males were collected along the edge of upland rainforest on the Broken River about 5 km SSW of Eungella on 15.ix.1993 and 10.iii.1994. They have the postmedian spots on the underside of the hindwing as a narrow continuous band, rather than as small dark discrete spots typical of *T. s. sombra* Waterhouse from the wet tropics of northern Queensland. Valentine (1988) noted the presence of *T. symmomus* in the Eungella area and suggested the population was closer to *T. s. sombra*. The above males, however, show a closer affinity to *T. s. symmomus* from central and southern Queensland, although it is possible that the Eungella population forms part of a cline between these two subspecies.

Hesperilla ornata (Leach)

Five pupae and several late instar larvae were collected from tussocks of *Gahnia aspera* growing in the relatively moist and deeply dissected sandstone gorges of the White Mountains National Park (20°28'S, 144°54'E) north of Torrens Creek, about 240 km inland from Townsville, on 5.ix.1994. Adults reared from this stock (4 males, 3 females) more closely resemble *H. o. ornata* than the northern *H. o. monotherma* (Lower). However, the pupal cap is distinctive, with the two long curved anterior projections fused to form a large circular disc. *H. o. ornata* reaches its northern limit on the coast at Airlie Beach (Dunn and Dunn 1991) about 400 km E of Torrens Creek, while *H. o. monotherma* reaches its southern limit in the rainforest belt at Paluma north-west of Townsville (Common and Waterhouse 1981). The pupal stage of these specimens varied from 19 to 22 days.

LYCAENIDAE

Acrodipsas brisbanensis (Miskin)

Four males were collected on the summit of St. Johns Peak (920 m), about 14 km S of Eungella (21°16'S, 148°28'E), on 11.iii.1994. This species was only recently discovered in north-eastern Queensland (Valentine and Johnson 1982, Lane 1985), however, there are no records of the species, or indeed the genus, between the dry eucalypt open-forests west of Paluma (the southern most point of the species range in north-eastern Queensland) and the Blackdown Tableland, approximately 600 km further south in central Queensland (Dunn and Dunn 1991). The presence of the species west of Mackay substantially bridges the disjunction in range of *Acrodipsas* between these two areas.

Hypochrysops delicia Hewitson

A male was collected on the summit of St. Johns Peak (920 m), about 14 km S of Eungella, on 11.iii.1994. The specimen was taken at 1430 h during overcast conditions as it settled on a leaf about 5 m from the ground. The upperside has the black margins relatively narrow and the blue area is rather extensive, similar to *H. d. duaringae* (Waterhouse). The locality

provides an important intermediate distribution record in north-eastern Queensland, bridging the 800 km disjunction in range between the Mt Garnet area west of the Atherton Tableland and the Blackdown Tableland, Westwood-Duaringa district in central Queensland (Common and Waterhouse 1981, Dunn and Dunn 1991, Lane 1995).

Ogyris genoveva Hewitson

A number of males were observed hilltopping between 1430-1600 hrs on the summit of St. Johns Peak (920 m), about 14 km S of Eungella, in dry eucalypt open-forest on 11 and 13.iii.1994. Their flight was extremely fast and occasionally they settled high up on dead eucalypt branches. One male, in slightly worn condition, was captured. No *O. zosine* Hewitson were in evidence at this locality. The specimen has the black termen of the forewing relatively narrow, has a wingspan of 50 mm and the upperside is dull purple. It is darker than specimens from central Queensland (assigned to *O. g. duaringa* Bethune-Baker) and coastal southern Queensland (assigned to *O. g. genoveva*) and cannot be placed to subspecies. Common and Waterhouse (1981) pointed out that the status of the recognised subspecies are doubtful. *O. genoveva* has been recorded previously as far north as Duaringa (Common and Waterhouse 1981, Dunn and Dunn 1991), however Common and Waterhouse (1981) mentioned two males, in the Australian Museum, from Kuranda and Little Mulgrave River (near Gordonvale), northern Queensland, which they assigned to *O. g. genoveva*. These specimens are labelled 'Kuranda, Qld, Mar. 1902, G.A. Waterhouse coll.' and 'Little Mulgrave River, Dec. 1905, F.H. Brown' respectively. The register in the Australian Museum indicates that the first specimen originated from the Goldfinch collection; however, there is uncertaintity as to where the specimen actually came from and who collected it. It could not have reached Waterhouse from F.P. Dodd as he did not live at Kuranda at that time (Monteith 1991). The second specimen bears an additional label 'passed through C. Wyatt Theft coll.'; hence the label data is unreliable since Wyatt removed labels from the specimens he stole. Moreover, these historic localities have not been confirmed by subsequent collectors and the species has not been collected in the seemingly suitable habitat of the dry upland eucalypt open-forests west of the Atherton Tableland (D. Lane, J. Young and G. Wood, pers. comm.). In view of these findings *O. genoveva* is best excluded from far northern Queensland until proven otherwise. The high altitude locality west of Mackay, which lies about 300 km NNW of Duaringa, should now be regarded as the established northern limit of *O. genoveva* in Queensland.

Hypolycaena danis C. & R. Felder

One adult was captured in upland rainforest in the Bluewater State Forest, approximately 35 km W of Bluewater near Townsville, by J.M. Billington on 30.xi.1992. This species has been recorded only recently from the urban areas of Townsville (Smythe 1993, Valentine 1993, Braby 1994) but

hitherto has not been recorded in the ranges between Townsville and Ingham.

Ionolyce helicon (Felder)

A single male was captured near the Broken River, about 5 km SSW of Eungella, in upland rainforest (above 700 m) on 12.iii.1994. On the mainland, the species ranges from Cape York to Ollera Creek 10 km NW of Rollingstone, with an isolated record about 650 km further south at Mt. Etna near Rockhampton (Common and Waterhouse 1981, Dunn and Dunn 1991). The species frequents rainforest habitats, appears to be local and, at times, can be numerous (Valentine and Johnson 1992). The Eungella locality provides an intervening distribution record between Rockhampton and Rollingstone.

Acknowledgments

Thanks are extended to David Lane, John Young and Graham Wood for helpful information. Max Moulds kindly provided expert assistance on northern records of *Ogyris genoveva* in the Australian Museum and Kelvyn Dunn made comments on an earlier draft of the manuscript. It is also a pleasure to thank Jeremy Billington for his company in the field.

References

BRABY, M.F. 1992. Range extensions and distribution records of some butterflies in north-eastern Queensland - Part II. *Victorian Entomologist* **22**: 51-55.

BRABY, M.F. 1994. Range extensions and distribution records of some butterflies in north-eastern Queensland - Part III. *Queensland Naturalist* **32**: 121-129.

BRABY, M.F. and DUNN, K.L. 1991. Range extensions and distribution records of some butterflies in north-eastern Queensland. *Victorian Entomologist* **21**: 62-66.

COMMON, I.F.B. and WATERHOUSE, D.F. 1981. *Butterflies of Australia*. Angus and Robertson: Sydney.

DUNN, K.L. and DUNN, L.E. 1991. *Review of Australian Butterflies: distribution, life history and taxonomy. Parts II & IV.* Published by the authors: Melbourne.

LANE, D. 1985. Notes on the biology and distribution of some Queensland butterflies. *Australian Entomological Magazine* **12**: 77-80.

LANE, D.A. 1985. Lepidopteran distribution and foodplant records for northern Queensland. *Victorian Entomologist* **25**: 37-38.

MONTEITH, G.B. 1991. *The Butterfly Man of Kuranda: Frederick Parkhurst Dodd.* Queensland Museum: South Brisbane.

SMYTHE, R. 1993. The not so beautiful butterfly. *Australian Orchid Review* October 1993: 4-5

VALENTINE, P.S. 1988. *Australian Tropical Butterflies.* Tropical Australia Graphics: Townsville.

VALENTINE, P.S. 1993. Urban butterflies - a provisional list for Townsville. *Entomological Society of Queensland News Bulletin.* **21**: 160-164.

VALENTINE, P.S. and JOHNSON, S.J. 1982. New records of Lycaenidae and Hesperiidae (Lepidoptera) from northern Queensland. *Australian Entomlogical Magazine* **9**: 1-3.

VALENTINE, P.S. and JOHNSON, S.J. 1992. Late dry season butterflies on Cape York Peninsula. *Victorian Entomologist* **22**: 87-91.

WILSON, W.J. 1984. New distribution records for some Queensland and New South Wales butterflies. *Australian Entomlogical Magazine* **11**: 59.

PHILOPHYLLA HUMERALIS (HENDEL) (DIPTERA: TEPHRITIDAE: TRYPETINAE) NEWLY RECORDED FROM AUSTRALIA

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Abstract

Philophylla humeralis (Hendel), comb. nov. is recorded from Dunk I., NE Queensland, the first Australian record.

Introduction

Permkam and Hancock (1995) recorded 35 genera and 77 species of Trypetinae from Australia, with 6 genera and 9 species placed in the tribe Trypetini. The following record came to hand too late to be included in that paper and brings to 5 the number of species of *Philophylla* Rondani now known from Australia.

Key to Australian species of *Philophylla*

1 Wing with a subapical oblique brown band in outer part of cell r_{4+5}, below the costal band 2
Wing without a subapical brown band below the costal band 4

2 Cells bc and c brown, paler centrally; brown band through dm-cu crossvein joined with discal patch in cell .... *australina* (Hardy)
Cells bc and c mostly hyaline; brown band through dm-cu crossvein normally free from discal patch, rarely joined below cell dm 3

3 Cell c hyaline with a brown longitudinal stripe along costa .... *fossata* (Fabricius)
Cell c brown with a medial quadrate hyaline band ...... *humeralis* (Hendel)

4 Cell bc brown; cell c with a medial quadrate hyaline band; brown bands in cell dm and below diverging .... *quadrata* (Malloch)
Cell bc hyaline; cell c with a medial elliptical hyaline band; brown bands in cell dm and below parallel or slightly converging .... *erebia* (Hering)

Philophylla humeralis (Hendel), comb. nov.

(Fig. 1)

Pseudospheniscus humeralis Hendel, 1915: 452. Type locality Friedrich-Wilhelmshafen, Papua New Guinea. HT ♀ in Természettudományi Museum, Budapest [not examined].

Myoleja humeralis (Hendel); Hardy, 1987: 323.

Material examined. Queensland: 1 ♂, Dunk I., via Mission Beach, N. Qld, 2.ix.1994, M. & G. De Baar (in QDPI).

Comments. This species is easily recognised by the wing pattern (Fig. 1),

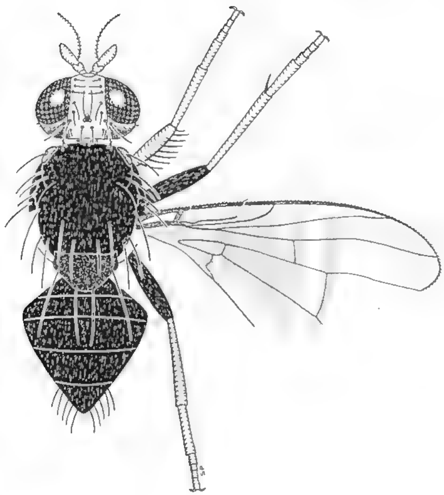

Fig. 1. *Philophylla humeralis*, male.

having cell bc hyaline, cell c brown with a medial quadrate hyaline band, a triangular hyaline indentation beyond cell sc, a complete hyaline band separating the brown distal C-shaped band from the discal brown area and an isolated subapical brown streak across outer portion of cell r_{4+5}. The postpronotal lobe, proepimeron and fore coxa are mostly or entirely fulvous and the female has an apically serrate and pointed aculeus (Hardy 1987).

Placement of this species in *Philophylla* follows Han (1992) and Permkam and Hancock (1995). The hostplant is unknown but related species breed in the berries of *Clerodendrum* and *Callicarpa* (Verbenaceae).

Distribution. Northern Queensland. Elsewhere known from mainland Papua New Guinea and New Britain (Hardy 1987).

Acknowledgments
I am grateful to Murdoch De Baar for bringing this interesting record to my attention and Susan Phillips for preparing the figure.

References
HAN, H.Y. 1992. Classification of the tribe Trypetini (Diptera: Tephritidae: Trypetinae). Unpublished Ph.D. thesis, The Pennsylvania State University, 274 pp.

HARDY, D.E. 1987. The Trypetini, Aciurini and Ceratitini of Indonesia, New Guinea and adjacent islands of the Bismarks and Solomons (Diptera: Tephritidae: Trypetinae). *Entomography* **5**: 247-373.

HENDEL, F. 1915. H. Sauter's Formosa-Ausbeute. Tephritidae. *Annales Historico Naturales Musei Nationalis Hungarici* **13**: 424-467.

PERMKAM, S. and HANCOCK, D.L. 1995. Australian Trypetinae (Diptera: Tephritidae). *Invertebrate Taxonomy*. In press.

A NEW SPECIES OF *OPODIPHTHERA* WALLENGREN (LEPIDOPTERA: SATURNIIDAE) FROM NORTHERN AUSTRALIA

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Abstract
Opodiphthera excavus sp. nov. and its mature larva are described from northern Australia. The hostplant is *Erythrophleum chlorostachys* (F. Muell.) (Caesalpiniaceae) and the larva spins its cocoon and pupates in the soil, a behaviour newly recorded for the subfamily Saturniinae.

Introduction
Recent collecting utilising mercury vapour lights produced 10 specimens (9 males, 1 female) of an undescribed species of *Opodiphthera* Wallengren from widely separated localities in northern Australia. During February 1993, mature larvae were discovered at Wolfram Camp, 27 km. north-west of Dimbulah, Qld, feeding upon the Cooktown Ironwood Tree *Erythrophleum chlorostachys* (F. Muell.) (Caesalpiniaceae) and pupating in the soil. During September 1994, pupae were found in similar situations 8 km NE of Walkamin, via Atherton, Qld, and more recently pupae and empty pupal cocoons were found in an area 50-70 km east of Georgetown, as well as near Mt Surprise, Qld.

In Australia the Saturniidae are represented by 12 named species referred to four genera of the Saturniinae. *Opodiphthera* contains nine species formerly contained in *Antheraea* Hübner, with a known distribution extending from the Northern Territory and northern Queensland to Victoria, South Australia, southern Western Australia and Tasmania (Common 1990).

Opodiphthera excavus sp. nov.

(Figs 1-4)

Type Material. QUEENSLAND: Holotype ♂, Wolfram Camp, 27 km NW of Dimbulah, bred ex pupa, 10.iv.1993, D.A. Lane, in Australian National Insect Collection (ANIC), Canberra. Paratypes: 1 ♀, same data as holotype but 12.iii.1993; 1 ♂, same data but 9.iv.1993; 1 ♀, same data but 28.ii.1993; 1 ♂, 11 miles S of Ravenshoe, 2700 ft, 20.iii.1964, I.F.B. Common and M.S. Upton; 1♂, 15°41'S 145°12'E, Annan River, 3 km W by S of Black Mt., Cooktown, 27.ix.1980, E.D. Edwards; 1♂, 12°40'S 142°40'E., Batavia Downs, 22-23.viii.1992, at light, P. Zborowski & J. Cardale, ANIC slide No. 3412; 1 ♂, 12°37'S 141°55'E, Dinah Creek, 17.ii.1994, P. Zborowski, ANIC slide No. 3413 (all in ANIC); 25 ♂♂, 10 ♀♀, same data as holotype but 19.ii.1993, 21.ii.1993, 24.ii.1993, 18.iii.1993, 23.iii.1993, 24.iii.1993, 9.iv.1993, 10.iv.1993, 12.iv.1993, 14.iv.1993, 7.xii.1993, 18.xii.1993, 27.i.1994, 12.ii.1994, 18.ii.1994, 13.iii.1994, 16.iii.1994, 26.iii.1994, 5.xi.1994, 8.xi.1994, 27.xi.1994, 30.xi.1994, 1.xii.1994, 12.ii.1995, 14.ii.1995, 24.ii.1995, D.A. Lane; 1 ♂, Palmer River xing, Cooktown Road, 26.iv.1985, D.A. Lane; 1 ♂, Chillagoe, 28.ii.1989, D.A. Lane; 1 ♂, Chillagoe, 20.i.1988, M.S. Moulds; 1 ♂,

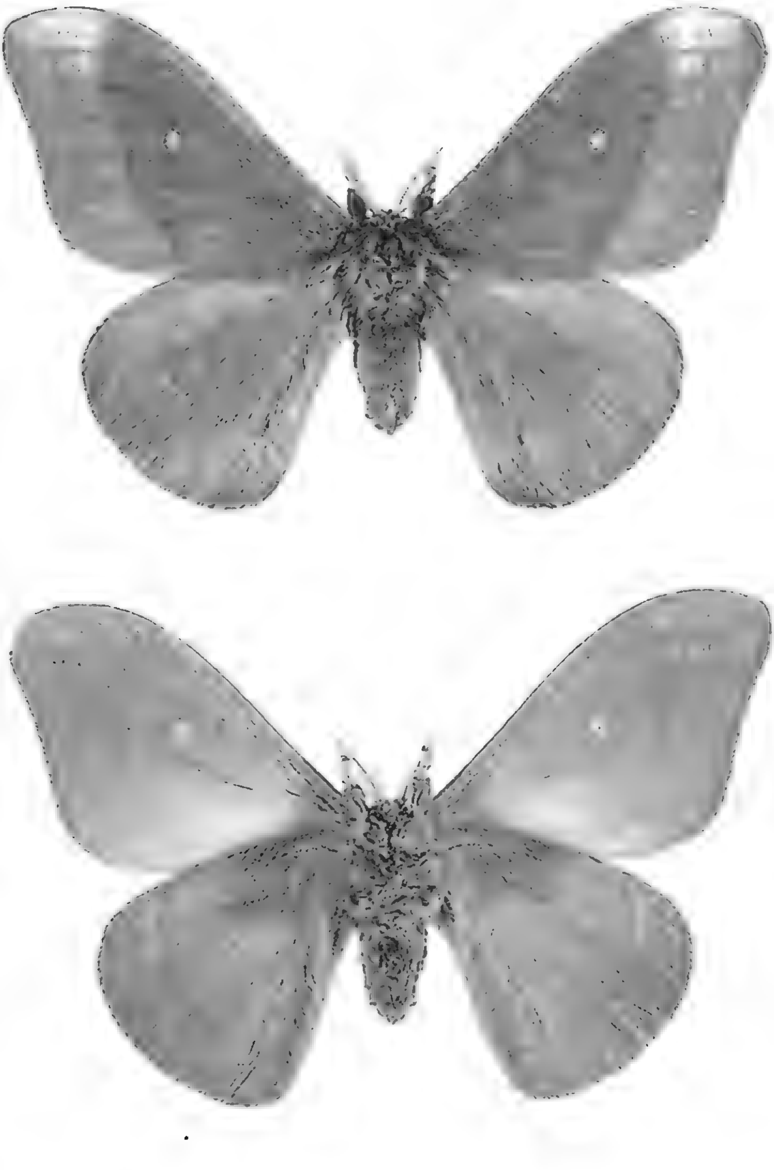

Fig. 1. *Opodiphthera excavus*, holotype male, upper and undersides.

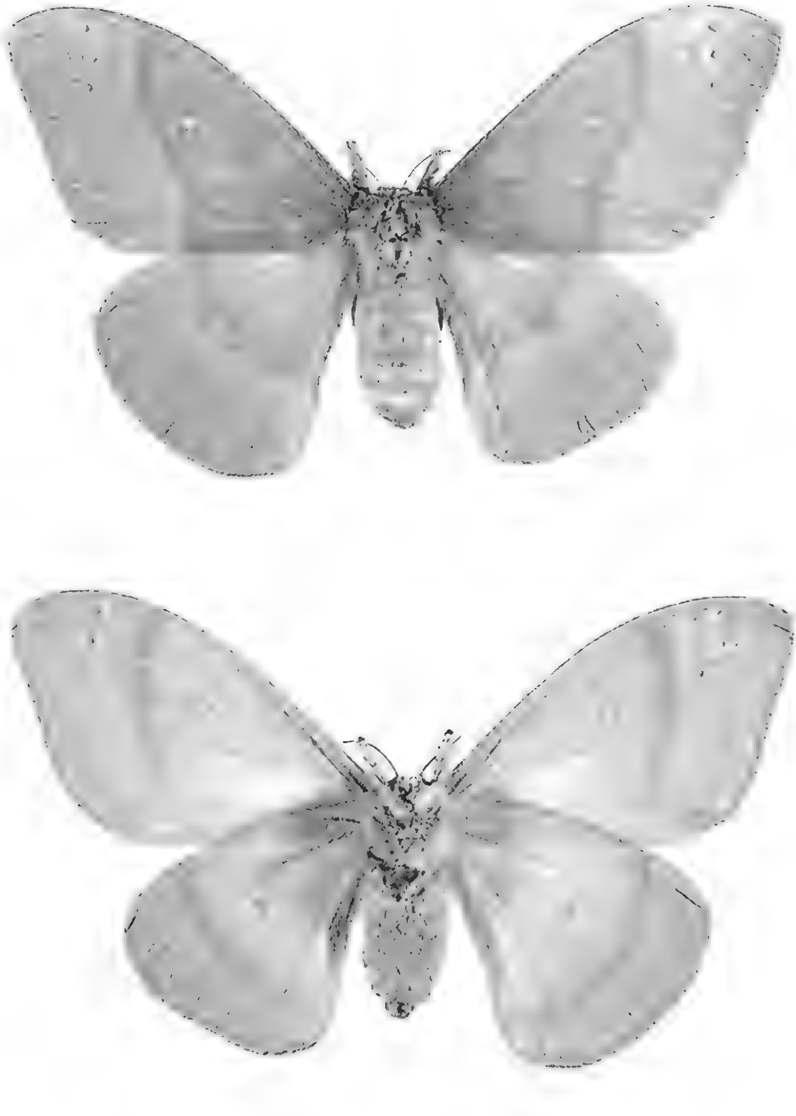

Fig. 2. *Opodiphthera excavus*, paratype female, upper and undersides.

8 km E Emuford, 30.xii.1989, M.S. Moulds; 20 ♂♂, 10 ♀♀, all labelled 7 km NE Walkamin, bred/pupa, but dated 7.x.1994, 8.x.1994, 10.x.1994, 14.x.1994, 17.x.1994, 19.x.1994, 20.x.1994, 22.x.1994, 24.x.1994, 26.x.1994, 28.x.1994, 29.x.1994, 7.xi.1994, 8.xi.1994, 9.xi.1994, 10.xi.1994, 11.xi.1994, 29.xi.1994, D.A. Lane (all in D.A. Lane collection, Atherton); 1 ♂, 1 ♀, same data but dated 7.x.1994, 8.x.1994 (in Queensland Museum). NORTHERN TERRITORY: 1 ♂, 11°01'S 136°45'E, Rimbija Island, Wessel Islands, 5.i.1977, E.D. Edwards (in ANIC).

Other material examined. QUEENSLAND: 1 ♀, Walkers Creek, near Normanton, 15.i.1991, M.S. Moulds (in D.A. Lane collection, Atherton).

Description

Male (Fig. 1). Forewing length 47-50 mm. Eyes black. Antennae broadly pectinate, pectinations about 10 times width of shaft. Head, thorax and abdomen all dark reddish brown.

Upperside: Forewing with costa straight for basal 2/3 then evenly but broadly bowed to apex; apex broadly rounded, termen concave, hindmargin straight and tornus rounded. Hindwing with termen evenly rounded, inner margin straight. Both wings dark reddish-brown with little variation in colour. Some specimens have a purplish suffusion giving a glossy appearance. Forewing with a cloudy whitish-grey area near costa from postmedian band to near apex, somewhat variable in size. A slightly wavy diffuse grey or red-grey line runs from the costa at 2/3 to about half inner margin, convex in upper half and slightly concave in lower half varying to nearly straight. A similar grey line, less distinct, from a little less than half costa to 1/3 inner margin and strongly indented below cell. Eye spot at end of cell small, transparent, ringed by a narrow greyish-white line. Hindwing with outer diffuse reddish-grey line running parallel to wing margin, inner diffuse reddish-grey line indistinct; eyespot an indistinct reddish-grey spot.

Underside: Similar to upperside but markings less distinct, the inner line absent. Forewing outer line closer to wing margin posteriorly; eyespot minute, transparent, without a surrounding line. Hindwing with outer line closer to wing margin than on upperside.

Female (Fig. 2). Forewing length 50-53 mm. Antennae with pectinations about 5 times width of shaft. Fore and hind wings as in male but broader and lighter in colour. Eyespots slightly larger, the cloudy white area near forewing apex absent.

Male genitalia (Fig. 3). Uncus blunt at apex, downcurved. Valva broad, short and triangular with a broadly rounded tip; dorsal lobe broad, downcurved with pointed apex.

Etymology. The specific name is derived from the Latin *ex*, out of and *cavus*, a hollow or hole. It is treated as a noun in apposition and refers to the larval habit of burrowing into the soil to pupate.

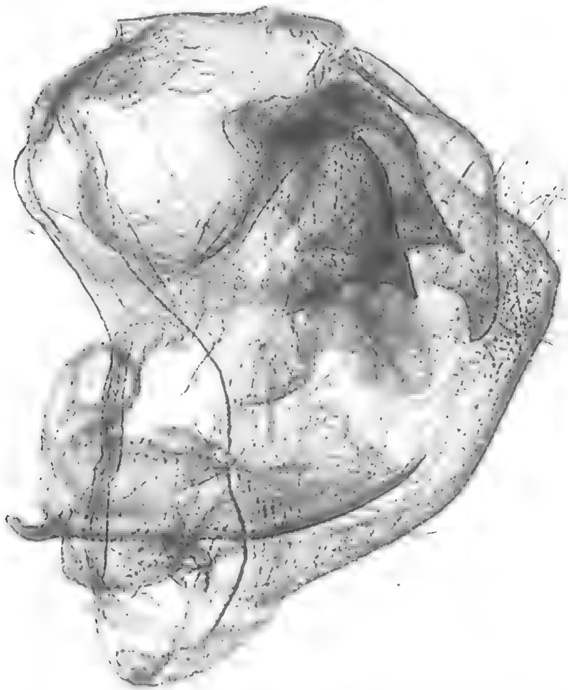

Fig. 3. *O. excavus*, male genitalia, ANIC slide 3413.

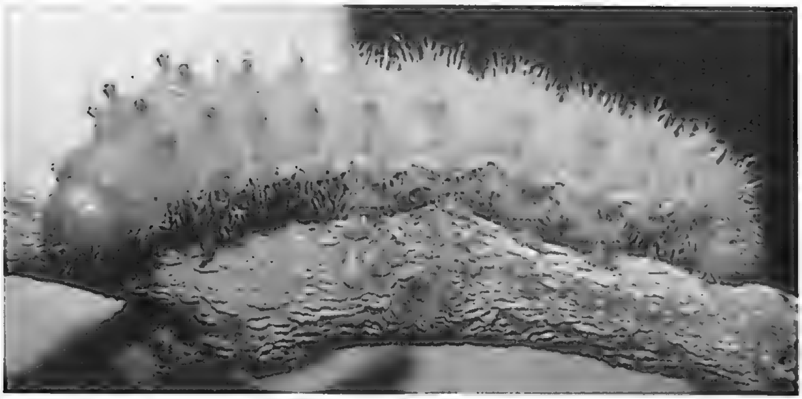

Fig. 4. *O. excavus*, mature larva, lateral view, on stem of hostplant.

Early stages and biology

Fifth instar larva (Fig. 4). Fairly stout, nearly uniformly green, with a covering of fine, whitish, secondary setae. Head smooth, green. Thorax with prothoracic shield green, meso- and metathorax with one dorsal and one subdorsal scolus on each side and one smaller lateral scolus; scoli green at base, shading to brown apically and with numerous fine whitish setae; thoracic legs dark greenish brown. Abdomen with segments 1-7 and 9 having one dorsal and one subdorsal scolus on each side and one smaller scolus below spiracle; scoli green at base, shading to dark green apically and with numerous fine whitish setae; segment 8 with one middorsal scolus and one subdorsal and one smaller lateral scolus on each side; segments 1-8 with a yellow lateral line connecting the lateral scoli; spiracles elliptical, orange; prolegs with numerous fine whitish setae; ventral prolegs stout, dark green; anal prolegs very stout, dark green. A covering of fine whitish secondary setae gives the larva a hairy appearance.

Parasitism. Several larvae of *O. excavus* collected at Wolfram Camp were found to be parasitised by a wasp, *Brachymeria* sp. (Chalididae) or by a tachinid fly (specimens deposited in ANIC), one larva being parasitised by both species.

Pupation. When ready to pupate mature larvae moved down the trunk of the host and immediately began to burrow into the soil around the base. At Wolfram Camp and near Walkamin the host grew on the sides of a low ridge, in a decomposed granite soil with soil fragments ranging from fairly coarse to a sandy loam. Such soil types are fairly friable, giving such a large larva reasonable accessibility. Larvae generally sought a pupation site within 30 cm from the base of the tree and burrowed to a depth of 40-50 mm below the surface to pupate. Pupae were located against the base of the tree, against or below buried or partly buried fallen sticks and branches, or freely scattered within the soil. They were always orientated with the anterior end uppermost, allowing the moth to reach the surface upon eclosion.

Cocoons are formed of a fairly tough silk, are oval in shape and fairly similar to, but not as rigid as those of other *Opodiphthera* species (Common 1990, Lane 1994). The cocoon is spun below the surface of the soil and incorporates small stones and soil particles, which enables it to blend into its surroundings. When digging for pupae, cocoons were often detected by touch rather than by sight. Adult emergence occurred after good rain, associated with hot, humid weather.

Distribution

Known from the far northern coast of the Northern Territory and in northern Queensland from Batavia Downs south to Ravenshoe and from near Cooktown to Mt Surprise, Georgetown and Normanton.

Discussion

This new species is best placed in *Opodiphthera* as the dorsal lobes of the male genitalia resemble those of other members of the genus; however *O. excavus* is not closely related to any of the other described species. The shape of the fore and hind wings and the reduced eyespots separate it from all others in the genus.

The female collected at Walkers Creek near Normanton is much paler in ground colour than females from other localities and is included tentatively until further specimens from the Normanton area become available.

Two males were collected at light in August and September, but all other specimens were collected or emerged from pupae during the period October to April. As larvae have only been observed in the wild during February, this suggests that the species has an annual life cycle. From 70 pupae collected at Wolfram Camp during February 1993, 29 emerged during Feb.-April 1993 or Dec. 1993-March 1994, suggesting that at least 50% of pupae lie dormant for 12 months or longer, giving the species the capacity, should dry conditions prevail, of having at least a two-year life cycle. Larvae and pupae were found associated only with mature trees and late instar larvae fed only on mature foliage. As the hostplant *E. chlorostachys* has a wide distribution in northern Australia, from north eastern Queensland to the Kimberley area of Western Australia (Boland *et al.* 1984), *O. excavus* may well have a much wider distribution than present records indicate.

The larval habit of tunnelling into the soil to pupate has not been recorded previously in the subfamily Saturniinae, although this behaviour is known to occur in the exotic subfamily Citheroniinae (Common 1990). Larvae live and pupate singly, but may be locally common when seasonal conditions (summer storms associated with hot humid weather) give rise to many emergences within a few days. In general, *O. excavus* appears to be fairly local in distribution, often selecting only old mature trees on which to oviposit. Aggregations of pupae at the base of certain trees can be fairly prolific, however the remains of many emerged pupal cocoons from several previous seasons may give a false impression of the relative abundance of the moth. The habit of the larvae in entering the soil to spin cocoons and pupate is of special interest and undoubtedly provides protection from bushfires and desiccation in a harsh environment.

Acknowledgments

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the parasite identifications and Garry Sankowsky of Tolga, whose initial observations of a saturniid species near Wolfram Camp some years earlier led to these findings.

References

COMMON, I.F.B. 1990. *Moths of Australia.* Pp. xxxii + 535. Melbourne University Press, Melbourne.

BOLAND, D.J., BROOKER, M.I.H., CHIPPENDALE, G.M., HALL, N., HYLAND, B.P.M., JOHNSTON, R.D., KLEINIG, D.A. and TURNER, J.D. 1984. *Forest Trees of Australia.* 687 pp. Nelson and CSIRO, Melbourne.

LANE, D.A. 1994. Notes on the life history of *Opodiphthera fervida* (Jordan) (Lepidoptera: Saturniidae). *Australian Entomologist* **21**: 37-38.

SEXUAL DIMORPHISM IN *MALLADA TRAVIATA* (BANKS) (NEUROPTERA: CHRYSOPIDAE)

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Abstract
Sexual dimorphism is recorded in *Mallada traviata* Banks for the first time. Males display varying degrees of enlargement of the posterior half of the prothorax, a feature not found in females.

Introduction
Mallada Navás is the largest and most widely distributed genus of the Chrysopidae, with at least 122 described species world-wide (Brooks and Barnard 1990). In Australia it is represented by at least 12 species, of which 10 are endemic. *Mallada traviata* (Banks) is distributed along the east coast of Australia, as far south as the Australian Capital Territory (Winterton 1995). Although largely seasonal, it is the most abundant chrysopid in coastal areas of Queensland but scarce inland (Winterton, unpublished data). The biology of *M. traviata* is unknown although the larval stages were described by Boros (1984).

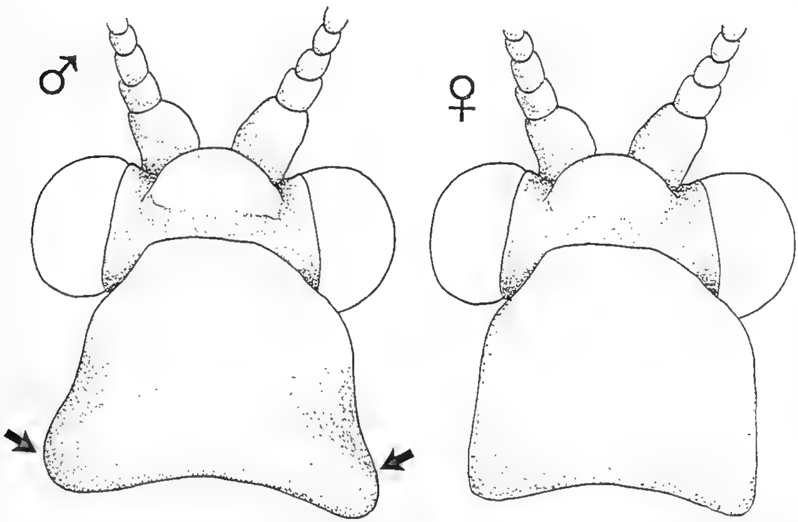

Fig. 1. *Mallada traviata* Banks, dorsal views of head and prothorax of male (left) and female (right).

Sexual Dimorphism
Sexual dimorphism is not common in the Chrysopidae, but has been recorded in 2 Australian species, namely *Mallada basalis* (Walker) and *M. signata*

(Schneider) (New 1980). In both species males have a distinctive thickening and/or shading of the forewing pterostigma, which are vibrated against the substrate during courtship. Dimorphism between sexes of certain nearctic species of *Meleoma* Fitch is dramatic with males developing large frontal processes (Garland 1985).

Mallada traviata males are distinguishable from females by a characteristic lateral enlargement of the posterior half of the prothorax, which in the female is not enlarged (Fig. 1). The degree of enlargement is variable between individuals and appears not to be related to either adult size or geographic variability. The range of prothoracic shape varies from the extreme form shown in figure 1 (left), to almost parallel-sided and similar to that of the female. The reason for this difference in prothoracic shape is unknown.

References

BOROS, C.B. 1985. Descriptions of the larvae of six Australian species of *Chrysopa* Leach *s.l.* (Neuroptera: Chrysopidae). *Australian Journal of Zoology* **32**: 833-849.

BROOKS, S.J. and BARNARD, P.C. 1990. The green lacewings of the world: a generic review (Neuroptera: Chrysopidae). *Bulletin of the British Museum of Natural History (Entomology)* **59**: 117-286.

GARLAND, J.A. 1985. Identification of Chrysopidae in Canada, with bionomic notes (Neuroptera). *Canadian Entomologist* **117**: 737-762.

NEW, T. R. 1980. A Revision of the Australian Chrysopidae (Insecta: Neuroptera). *Australian Journal of Zoology Supplementary Series* **77**: 1-143.

WINTERTON, S.L. 1995. A new species of *Mallada* Navás (Neuroptera: Chrysopidae) from Australia with a key to species. *Journal of the Australian Entomological Society* **34** (1): 23-27.

HERBIVOROUS INSECTS ASSOCIATED WITH THE PAPERBARK *MELALEUCA QUINQUENERVIA* AND ITS ALLIES: IV. TORTRICIDAE (LEPIDOPTERA)

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Abstract

We conducted surveys in northern and southeastern Queensland and in northern New South Wales to detect potential agents for the biological control of *Melaleuca quinquenervia* in Florida, USA, where it has become a serious pest. This paper presents records for 21 taxa of tortricid moths collected and reared on six *Melaleuca* species. Several of these Tortricidae may deserve further study as potential biocontrol agents for *M. quinquenervia.*

Introduction

Despite the diversity (around 250 species) and wide distribution of *Melaleuca* spp. (Barlow 1988), the herbivores associated with this genus are poorly known. The paperbark trees in the *Melaleuca leucadendra* (L.) L. complex (Blake 1968) are conspicuous and widespread along Australia's eastern and northern coastlines. Since its introduction as an ornamental in southern Florida, U.S.A. at the beginning of the century, *Melaleuca quinquenervia* (Cav.) S.T. Blake, a member of this complex, has become a serious pest. Since late 1986 we have regularly collected insect herbivores in Australia associated with *M. quinquenervia* and its close relatives in the *M. leucadendra* complex, in order to determine those that may have potential as biocontrol agents. We have presented records for 22 species of Noctuoidea (Balciunas *et al.* 1993a), 17 species of Geometridae (Balciunas *et al.* 1993b) and 31 species of Gelechioidea (Burrows *et al.* 1994) which we reared from *M. quinquenervia* and its close relatives. In this paper we present collection and rearing records for 21 taxa of Tortricidae. All are apparently new host records.

Methods

Nearly all the tortricids were collected as larvae, and reared on the tree species from which they were collected. Most were collected in quantitative samples (described in Balciunas *et al.* 1993a) from 1986-1993. These consisted of approximately 1 kg of plant material, collected in the field, then sorted in the laboratory. The remaining Tortricidae were collected directly from trees in the field or at our shadehouses. Adults were identified by one of the authors (M. Horak) as far as possible. Many tortricid genera are in need of revision and the generic classification of the Australian myrtaceous-feeding representatives of the tribe Eucosmini is totally inadequate. The names used in this paper are

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Table 1. Tortricidae species reared from *Melaleuca quinquenervia* and eight other myrtaceous tree species.

Species	Collection site	Host plant[1]	Stage and no. collected	Date collected	Plant part fed upon	Life-history information (pp = pupal period)
Tortricinae						
Archipini						
Adoxophyes templana (Pagenstecher)	Cardwell Swamp	Mdl	Larva	18.viii.86		Adult emerged
	James Cook University	Mqn	Larva	20.xi.89	Tip-binder	Adult emerged 3.xii.89
	James Cook University	Mqn	Larva	1.viii.91	Leaf-binder	Adult emerged 26.viii.91, pp=>8 d
Adoxophyes sp. B	Howard River	Mnv	Larva	24.x.86		Adult emerged
Adoxophyes sp. C[2]	Forrest Beach West	Mqn	Larva	29.ix.92	Leaf-grazer	Adult emerged before 19.xi.92
Epiphyas postvittana (Walker)[3]	Redbank	Mqn	Larva	27.v.87	Flowers	Adult emerged
Isotenes cf. *miserana* (Walker)[4]	Byron Bay Industrial Park	Mqn	Larva	17.vii.88	Flowers	Adult emerged
	Daintree Swamp	Mcj	Larva	8.vi.92	Leaf-binder	Adult emerged 30.vi.92
	Daintree Swamp	Mcj	Larva	5.vii.93	Leaf-binder	Adult emerged 9.viii.93, pp=8 d
	Eubenangee Swamp	Mqn	Pupa	3.viii.87		Adult emerged 10.viii.87
	Eubenangee Swamp	Mqn	2 larvae	15.ix.87		2 adults emerged 6.x.87
	Eubenangee Swamp	Mqn	Pupa	7.viii.89		Adult emerged 16.viii.89
	Feluga Site 1	Mqn	Larva	23.viii.93	Tip-binder	Adult emerged 16.xi.93
	Forrest Beach West	Mqn	Larva	4.xi.93	Tip-binder	Adult emerged
	Hubinger Road	Mqn	Larva	12.x.93	Leaf-binder	Adult emerged 3.xi.93
	Hubinger Road	Mqn	2 larvae	4.xi.93	Leaf-binder	2 adults em. 26.xi.-2.xii.93, pp=9 d
	Indooroopilly	Mqn	Larva	1992	Inside gall[5]	Adult emerged
	Maclean	Mqn	Larva	28.xi.88	Tip-binder	Adult emerged 13.xii.88
	Maclean	Mqn	Larva	10.x.89		Adult emerged 22.xi.89, pp=12 d
	Maclean	Mqn	Pupa	20.iii.90		Adult emerged 27.iii.90
	Maclean	Mqn	Larva	19.xi.90	Leaf-binder	Adult emerged 12.xii.90, pp=7 d
	Murrigal	Lsv	Larva	5.xi.93	Leaf-binder	Adult emerged
	Tully Heads Road	Mqn	Pupa	9.xi.93		Adult emerged 23.xi.93
	Tully Heads Road	Mlb	Larva	9.xi.93	Tip-binder	Adult emerged 17.xii.93, pp=9 d

	Woodward Park	Mqn	3 larvae	3.ix.92	Tip-binder	3 adults em. 18.ix.-2.x.92, pp=7-9 d
	Woodward Park	Mqn	7 larvae	9.xi.92	Leaf, tip-binder	7 adults emerged 7-10.xii.92
	Woodward Park	Mqn	Larva	12.ix.93	Leaf-binder	Adult emerged 4.x.93, pp=7 d
	Woodward Park	Mqn	Larva	25.x.93	Leaf-binder	Adult emerged 10.xi.93, pp=5 d
Isotenes sp. E[6]	Daintree Swamp	Mqn	Larva	6.v.91		Adult ♂ emerged
	Feluga Site 1	Mqn	Larva	29.ix.92	Tip-binder	Adult emerged
	Forrest Beach West	Mqn	Larva	12.ix.92	Tip-binder	Adult emerged
	Forrest Beach West	Mqn	Larva	12.x.93	Tip-binder	Adult emerged 1.xi.93, pp=6 d
	Hubinger Road	Mqn	Larva	12.x.93	Leaf-binder	Adult emerged 5.xi.93, pp=7 d
	Murrigal	Mqn	Larva	12.x.93	Tip-binder	Adult emerged 9.xi.93
	Woodward Park	Mqn	9 larvae	3.ix.92	Tip-binder	9 adults em. 18.ix.-11.x.92, pp=6-10 d
	Woodward Park	Mqn	Larva	12.ix.92	Tip-binder	Adult emerged
	Woodward Park	Mqn	Larva	29.ix.92	Tip-binder	Adult emerged
	Woodward Park	Mqn	Larva	9.xi.92	Tip-binder	Adult emerged 25.xi.92
	Woodward Park	Mqn	Larva	25.x.93	Tip-binder	Adult emerged 23.xi.93, pp=8 d
Olethreutinae						
Olethreutini						
Dudua aprobola (Meyrick)[7]	Apex Park	Mlb	Larva	13.viii.90	Leaves	Adult emerged
	Eubenangee Swamp	Mqn	Larva	4.v.87	Flowers	Adult emerged 27.v.87, pp=12 d
	Eubenangee Swamp	Mqn	5 larvae	6.v.88	Flowers	5 adults emerged
	Feluga Site 1	Mqn	Larva	25.vii.88	Flowers	Adult emerged
	Forrest Beach West	Mqn	Larva	28.v.91	Flowers	Adult emerged 22.vi.91, pp=15 d
	Three Mile Creek	Mlb	2 larvae	25.vii.90	Flowers	2 adults emerged
	Woodward Park	Mqn	Pupa	9.vii.90		Adult emerged
Lobesia cf. *peltophora* (Meyrick)	Boundary Street	Mqn	Larva	20.v.92	Flowers	Adult emerged 18.vi.92
	Eclipse Street	Mlb	Larva	16.vii.91	Leaf-binder	Adult emerged 9.viii.91
	Eubenangee Swamp	Mqn	2 larvae	6.v.88	Flowers	Adult emerged 2.vi.88
	James Cook University	Mqn	5 larvae, 2 pupae	18.v.92	Flowers	5 adults emerged

Table 1 (cont.). Tortricidae species reared from *Melaleuca quinquenervia* and eight other myrtaceous tree species.

Species	Collection site	Host Plant	Stage and number collected	Date collected	Plant part fe upon	Life history information (pp=pupal period)
Lobesia cf. *peltophora*	Oonoonba	Mqn	2 larvae	19.v.93	Flowers	2 adults emerged
(cont.)	Willows Shopping Centre	Mqn	2 larvae	17.v.92	Flowers	2 adults emerged 7&12.vi.92
Lobesia peltophora-	Aspley	Mqn	Larva	21.ii.88	Flowers	Pupated 11.iii.88, failed to emerge
complex	Chelmer	Mqn	Larva	2.vii.92	Mlb flowers[8]	Adult emerged 27.vii.92, pp=18 d
	Redbank	Mqn	Larva	27.v.87		Adult emerged
	Sherwood	Mqn	2 larvae	1.vii.87		2 adults emerged
	Sunnybank	Mqn	2 larvae	6.iv.87		2 adults emerged
	Taringa	Mqn	2 larvae	24.ii.92	Flowers	Pupated 2.iii.92, adult emerged
	Tennyson	Mqn	Larva	25.v.92	Mlb flowers[8]	Adult emerged 22.vi.92, pp=19 d
	The Pines	Mqn	4 larvae	10.iv.88	Flowers	3 adults em. 28.iv.-13.v.88, pp=9-12 d
	Woodburn	Mqn	Larva	5.vi.90	Leaves	Adult emerged
	Woodward Park	Mqn	Larva	13.vii.87	Leaves	Adult emerged 30.vii.87
Ophiorrhabda sp.	Centenary Park	Mlb	Larva	3.viii.87	Leaves	Adult ♀emerged
	Hyde Park Shopping Centre	Mlb	Larva	5.iii.91	Leaf-binder	Adult ♀ emerged 7.iv.91, pp=10 d
	Three Mile Creek	Mlb	4 larvae	8.iv.91	Leaf-binder	Adult ♂ emerged
Eucosmini						
"*Bathrotoma*" *quietana*	Burpengary	Mqn	Larva	20.xi.89	Leaves	Adult emerged 16.xii.89, pp=23 d
(Meyrick)	Burpengary	Mqn	Larva	3.i.90	Tip-binder	Adult emerged 18.i.90, pp=8 d
	Burpengary	Mqn	Larva	22.vi.92	Tip-binder	Adult emerged 20.vii.92, pp=7 d
	Chelmer	Mqn	Larva	2.vii.92	Tip-binder	Adult emerged 24.vii.92, pp=4 d
	Coolum	Mqn	Larva	11.ii.91	Inside gall[9]	Adult emerged 27.ii.91, pp=8 d
	Ernest	Mqn	Larva	1.viii.89	Tip-binder	Adult emerged 9.ix.89, pp=16 d
	Eubenangee Swamp	Mqn	Larva	25.v.87		Adult emerged 11.vi.87
	Fitzgibbon	Mqn	Larva	5.vii.89	Tip-binder	Adult emerged 1.viii.89, pp=14 d
	Fitzgibbon	Mqn	Larva	26.vii.89		Adult emerged 28.viii.89, pp=22 d

	Howard River	Mnv	Larva	24.x.86		Adult emerged
	Indooroopilly	Mqn	Larva	24.i.92	Tip-binder	Adult ♀ 5.ii.92, pp=8 d
	Indooroopilly	Mqn	Larva	21.ii.92	Tip-binder	Adult emerged 2.iii.92
	Indooroopilly	Mqn	Larva	21.iv.92	Tip-binder	Adult emerged 13.v.92, pp=14 d
	James Cook University	Mqn	Larva	4.vii.91	Tip-binder	Adult emerged 8.viii.91
	Landsborough	Mqn	Larva	17.x.89	Tip-binder	Adult emerged 6.xi.89, pp=13 d
	Oonoonba	Mqn	Larva	27.i.93	Tip-binder	Adult emerged
	Taringa	Mqn	Larva	24.ii.92	Flowers	Adult emerged 12.iii.92, pp=10 d
	Tibrogargan	Mqn	Larva	8.iii.89	Tip-binder	Adult emerged
	Willows Shopping Centre	Mqn	Larva	18.iii.91	Tip-binder	Adult emerged 17.iv.91
	Woodward Park	Mqn	Larva	25.x.93	Tip-binder	Adult emerged 13.xi.93, pp=5 d
Bathrotoma sp. B	Willows Shopping Centre	Mqn	Larva	17.v.92	Flowers	Adult emerged
Bathrotoma sp. E	Willows Shopping Centre	Mqn	Larvae	18.iii.91	Tip-binder	3 adults emerged 2-5.iv.91, pp=7 d
Holocola thalassinana	Ernest	Mqn	Larva	4.x.89	Tip-binder	Adult emerged 19.x.89, pp=13 d
Meyrick[10]	Ernest	Mqn	Larva	1.viii.89	Tip-binder	Adult emerged 4.ix.89, pp=14 d
	Fitzgibbon	Mqn	Larva	26.vii.89	Tip-binder	Adult emerged 28.viii.89, pp=24 d
	Fitzgibbon	Mqn	Larva	26.vii.89	Tip-binder	Adult emerged 22.ix.89
	Landsborough	Mqn	Larva	23.viii.89	Tip-binder	Adult emerged 7.ix.89, pp=10 d
	Redbank	Mqn	Larva	21.v.87		Adult emerged
	Sherwood	Mqn	Larva	22.ii.89	Flowers	Adult emerged
	Stapylton	Mqn	Larva	14.x.89	Tip-binder	Adult emerged 24.x.89, pp=6 d
	Sunnybank	Mqn	Larva	6.iv.87		Adult emerged
Holocola sp. B	Boundary Street	Mqn	Larva	20.v.92	Flowers	Adult emerged
	Boundary Street	Mdl	Larva	19.v.93	Tip-binder	Adult emerged 27.vi.93, pp=24 d
	James Cook University	Mqn	Pupa	27.ii.92		Adult ♂ emerged 2.iii.92
	Rockingham Road	Mvr	Larvae	12.iii.91	Flowers	5 adults emerged 27.iii.-7.iv.91
	Rockingham Road	Mvr	Larvae	12.iii.91	Flowers	6 adults emerged
	Willows Shopping Centre	Mqn	2 adults	17.v.92		
	Willows Shopping Centre	Mqn	18 larvae and pupae	18.i.93	Flowers	18 adults emerged 21.i.-5.ii.93
	Willows Shopping Centre	Cvm	Larva	3.x.93	Tip-binder	Adult emerged 18.x.93

Table 1 (cont.). Tortricidae species reared from *Melaleuca quinquenervia* and eight other myrtaceous tree species.

Species	Collection site	Host Plant	Stage and number collected	Date collected	Plant part fe upon	Life history information (pp=pupal period)
Holocola sp. C	Angus Smith Drive	Mvr	Larva	6.ii.92	Tip-binder	Adult emerged 29.ii.92, pp=20-22d
Holocola sp. D	Fitzgibbon	Mqn	Larva	27.vii.89	Tip-binder	Adult ♂ emerged 2.ix.89, pp=25 d
Holocola sp. E	Lennox Head	Mqn	Larva	11.ix.90	Tip-binder	Adult emerged 3.x.90, pp=9 d
Strepsicrates prob. *dyselia* (Turner)[11]	Berrimah Cons. Comm. Nursery	Mcj	Larva	28.x.86	Leaf-binder	Adult emerged 12.xi.86
	Berrimah Cons. Comm. Nursery	Mnv	Pupa	28.x.86		Adult emerged 6.xi.86
	Bracken Ridge	Mqn	Larva	1.viii.90	Tip-binder	Adult emerged 8.x.90, pp=14 d
	Burpengary	Mqn	Larva	1.viii.90	Tip-binder	Adult emerged 1.x.90, pp=10 d
	Double Barrel Creek	Mdl	2 larvae	4.xi.93	Tip-binder	2 adults emerged 26-30.xi.93
	Eubenangee Swamp	Mqn	Larva	6.v.88	Flowers	Adult emerged 1.vi.88
	Feluga Site 1	Mqn	2 larvae	23.iii.93	Tip-binder	2 adults emerged
	Feluga Site 1	Mqn	Larva	12.x.93	Tip-binder	Adult emerged 5.xi.93, pp=8 d
	Feluga Site 4	Mqn	2 larvae	23.viii.93	Tip-binder	Adult ♀ emerged 20.ix.93
	Forrest Beach West	Mqn	Larva	1.viii.89	Tip-binder	Adult ♂ emerged
	Forrest Beach West	Mqn	Pupa	12.ix.92		Adult ♀ emerged 18.ix.92
	Forrest Beach Swamp	Mqn	2 larvae	29.ix.92	Tip-binder	2 adults emerged 18-27.x.92
	Forrest Beach Swamp	Mqn	3 larvae	4.xi.93	Tip-binder	3 adults em. 26-28.xi.93, pp=5 d
	Forrest Beach Swamp	Ets	Larva	4.xi.93	Leaf-binder	Adult emerged 23.xi.93
	Hubinger Road	Mqn	6 larvae	12.x.93	Tip-binder	6 adults em. 21.x.-4.xi.93, pp=7-9 d
	Indooroopilly	Mqn	4 larvae	25.iii.92	Tip-binder	2 adults em. 7-9.iv.92, pp=10-11 d
	Indooroopilly	Mqn	2 pupae	4.iv.92	Tip-binder	2 adults emerged 9&10.iv.92
	Murrigal	Mqn	Larva	23.viii.93	Tip-binder	Adult ♀ emerged 14.ix.93
	Murrigal	Mqn	Larva	12.x.93	Tip-binder	Adult emerged 27.x.93, pp=9 d
	Nathan Plaza	Mqn	Larva	5.iii.91	Leaf-binder	Adult ♀ emerged 8.iv.91
	Oonoonba	Mqn	Larva	27.i.93	Tip-binder	Adult ♂ emerged 16.ii.93

	Woodford	Mqn	Larva	22.x.90		Adult emerged 16.xi.90, pp=4 d
	Woodward Park	Mqn	2 larvae	12.ix.93	Tip-binder	2 adults em. 27-28.ix.93, pp=7-8 d
Strepsicrates cf. *semicanella* (Walker)[11]	Alva Beach	Mdl	Larva	11.ix.86		Adult emerged
	Cardwell Swamp	Mqn	2 larvae	23.vi.93	Tip-binder	2 adult ♂ em. 21-22.vii.93, pp=9-10 d
	Edmund Kennedy Nat. Park	Mqn	2 larvae	11.vii.88	Tip-binder	2 adults emerged 8.viii.88
	Edmund Kennedy Nat. Park	Mqn	Larva	25.vii.88	Flowers	Adult emerged 28.viii.88
	Eubenangee Swamp	Mqn	3 larvae	6.v.88	Flowers	3 adults emerged
	Eubenangee Swamp	Mqn	2 pupae	29.vii.88		2 adults emerged 15&17.viii.88
	Feluga Site 1	Mqn	2 larvae	15.ix.87		2 adults emerged 2&5.x.87
	Feluga Site 1	Mqn	5 larvae	15.vi.88	Flowers	Adult emerged
	Feluga Site 1	Mqn	18 larvae	11.vii.88	Flowers	12 adults emerged 25.vii-8.viii.88
	Feluga Site 1	Mqn	6 larvae	25.vii.88	Flowers	2 adults emerged 8-15.viii.88
	Feluga Site 2	Mqn	2 larvae	11.vii.88	Flowers	Adult emerged 28.vii.88
	Fitzgibbon	Mqn	Larva	1.viii.90	Tip-binder	Adult emerged 2.x.90, pp=11 d
	Forrest Beach West	Mqn	2 larvae	1.viii.89	Tip-binder	2 adults emerged 23-29.viii.89, pp=16-26 d
	Forrest Beach West	Mqn	3 larvae	13.viii.89	Tip-binder	3 adults emerged 1.ix.89, pp=10 d
	Forrest Beach West	Mqn	5 larvae	14.viii.90	Tip-binder	Adult emerged
	Forrest Beach West	Mqn	Larva	29.ix.92	Tip-binder	Adult ♂ emerged
	Indooroopilly	Mqn	2 larvae	12.ii.92	Tip-binder	2 adults em. 24-27.ii.92, pp=8-10 d
	Indooroopilly	Mqn	Pupa	12.ii.92		Adult emerged 20.ii.92
	James Cook University	Mqn	Larva	1.vii.93	Tip-binder	Adult ♀ emerged
	James Cook University	Cvm	Larva	29.xi.93	Tip-binder	Adult ♀ emerged
	Nathan Plaza	Mqn	Larva	5.iii.91	Tip-binder	Adult emerged 21.iii.91
	Oonoonba	Mqn	Mqn	3.viii.93	Tip-binder	Adult ♀ emerged 27.viii.93
	Pallarenda	Mlb	Larvae	16.vi.93	Tip-galls[12]	9 adults emerged 2-20.vii.93
	Pallarenda	Mlb	Larva	29.vi.93	Tip-galls[12]	Adult ♀ emerged
	Pallarenda Retirement Home	Mqn	Pupa	17.iii.89		Adult emerged 5.iv.89
	Palm Beach Soccer Club	Mqn	Larva	17.iv.88	Flowers	Adult emerged

Table 1 (cont.). Tortricidae species reared from *Melaleuca quinquenervia* and eight other myrtaceous tree species.

Species	Collection site	Host Plant	Stage and number collected	Date collected	Plant part fe upon	Life history information (pp=pupal period)
	Pottsville	Mqn	Larva	17.viii.88	Tip-binder	Adult emerged
	Rowes Bay Golf Club	Mlb	Larva	21.vii.86		Adult emerged
	Willows Shopping Centre	Mqn	Larva	3.viii.93	Tip-binder	Adult ♀ em. 20.viii.93, pp=11 d
	Woodward Park	Mqn	2 larvae	29.vii.88	Tip-binder	2 adults emerged 28.viii.88
	Woodward Park	Mqn	13	7.viii.89	Fruit	Adult emerged
	Woodward Park	Mqn	Larva	9.vii.90		Adult emerged
	Woodward Park	Mqn	2 pupae	3.ix.92		2 adult ♀ emerged 17-18.ix.92
Strepsicrates cf. *transfixa* (Turner)[11]	Feluga Site 1	Mqn	Larva	11.vii.88		Adult emerged 31.vii.88
	Caloundra	Mqn	Larva	18.vii.89	Tip-binder	Adult ♀ emer. 26.viii.89, pp=21 d
	Ernest	Mqn	Larva	4.x.89	Tip-binder	Adult ♀ emerged 19.x.89, pp=13 d
	James Cook University	Mqn	Larva	1.vii.93	Tip-binder	Adult ♂ emerged
	James Cook University	Cvm	Larva	29.xi.93	Tip-binder	Adult ♂ emerged 11.xii.93
	Pallarenda	Mlb	Larva	16.vi.93	Tip-galls[12]	Adult emerged 6.vii.93

1 Mqn = *M. quinquenervia*, Mcj = *M. cajuputi*, Mdl = *M. dealbata*, Mlb = *M. leucadendra*, Mnv = *M. nervosa*, Mvr = *M. viridiflora*, Cvm = *Callistemon viminalis*, Ets = *Eucalyptus ?tessellaris*, Lsv = *Lophostemon suaveolens*.
2 Probably an undescribed species.
3 A notorious pest with over 250 host plants in New Zealand alone (Suckling *et al.* 1990), plus others listed in Common (1990) and Swaine *et al.* (1991).
4 *Isotenes miserana* feeds on the leaves of many trees and also on the fruit of economic crops (Common 1990).
5 Larva fed and pupated within a "fleshy-tip" gall formed by *Fergusonina* sp. (Diptera: Fergusoninidae).
6 Probably an undescribed species. Looks similar to *I. miserana* but ♀ has a dark grey anal tuft.
7 *Dudua aprobola* is a polyphagous minor orchard pest in the oriental-Australian region (Van der Geest and Evenhuis 1991) and has also been recorded from the introduced *Mimosa pigra* (Mimosaceae) in the Northern Territory (Wilson *et al.* 1990).
8 *M. quinquenervia* flowers unavailable.
9 Larva collected within "puff-ball" gall.
10 *Holocola thalassinana* also feeds upon *Leptospermum laevigatum* (Meyrick 1882, 1911; McQuillan 1992).
11 All *Strepsicrates* identifications are tentative as the genus needs revision and species can only be reliably identified by dissection.
12 Larvae bored through tip-galls.
13 Adult emerged from woody fruit. May have been collected as a larva or pupa.

the most appropriate currently available, but generic assignments are tentative only. The staff at the U.S. Dept. of Agriculture's Australian Biological Control Laboratory (ABCL) associated the larvae with the identified adults. A respresentative series of specimens will be held at the ABCL, while the majority of specimens will be deposited at the Australian National Insect Collection (ANIC) in Canberra.

The Tortricidae were collected and reared on *M. quinquenervia* or one of five of its close relatives in the *M. leucadendra* complex: *M. leucadendra*, *M. dealbata* S.T. Blake, *M. viridiflora* Sol. ex Gaertn., *M. nervosa* (Lindl.) Cheel, and *M. cajuputi* Powell. Records for specimens of several of the same tortricid species collected on *Callistemon viminalis* (Sol. ex Gaertn.) G. Don ex Loudon, *Eucalyptus ?tessellaris* F. Muell. and *Lophostemon suaveolens* (Sol. ex Gaertn.) Peter G. Wilson & J.T. Waterhouse (all Myrtaceae) also are presented.

Our collecting was concentrated in two main regions of the Australian east coast. In northern Queensland (**NQ**), our regularly sampled sites ranged from the Daintree River, north of Cairns, to Townsville. Our second major collecting region was from Coolum in southeastern Queensland (**SQ**) to Grafton in northern New South Wales (**NSW**). Most of the site locations in this paper have been listed in the three previous papers in this series (Balciunas *et al.* 1993a, 1993b, Burrows *et al.* 1994). The NQ sites listed here for the first time are: **Alva Beach** (19°27.5'S 147°28.9'E), 15 km NE of Ayr; **Eclipse Street*** (19°14.4'S 146°47.2'E), Townsville; **Rowes Bay Golf Club*** (19°13.8'S 146°46.5'E), Townsville; and **Willows Shopping Centre*** (19°19.1'S 146°43.5'E), Townsville. The SQ sites listed here for the first time are: **Ernest** (27°55.5'S 153°23.2'E), 62 km SE of Brisbane GPO; **Landsborough** (26°48.2'S 152°58.9'E), Brisbane; **Redbank*** (27°36.1'S 152°52.9'E), 21 km SW of Brisbane GPO; **Tennyson*** (27°31.5'S 152°59.4'E), 7 km SSW of Brisbane GPO; and **Woodford** (26°55.6'S 152°46.1'E), 68 km NW of Brisbane GPO. We also present records from NSW at **Maclean** (29°26.9'S 153°13.7'E), 145 km S of Coolangatta GPO and the Northern Territory at **Howard River** (12°27.7'S 131°04.9'E), 31 km W of Darwin. Sites marked with an asterix (*) are either ornamental plantings or forest remnants in urban areas.

Results

Our collection and rearing records for Tortricidae are presented in Table 1.

Discussion

There are assumed to be about 1230 species of Tortricidae in Australia (Nielsen and Common 1991), half of which are named. The majority of Australian tortricids are believed to have coevolved with the Australian plant communities, most notably with eucalypts and other Myrtaceae (Common 1980). Common (1980) reported that out of 199 reared species, 53 were from

Eucalyptus spp. Two separate groups within the Tortricidae concentrate on myrtaceous host plants, the tribe Epitymbiini in the Tortricinae and several genera of the tribe Eucosmini in the Olethreutinae. The Epitymbiini largely feed on dead leaves, including the 40 species reared from dead eucalypt leaves (Common 1980). A majority of the few species reared in the genera *Strepsicrates* Meyrick, *Holocola* Meyrick, *Bathrotoma* Meyrick and related eucosmine genera have myrtaceous host plants (ANIC rearing records, McQuillan 1992). For the present study, we reared some 21 tortricid taxa from a few *Melaleuca* species, without sampling dead leaves. Half of these belong to the Eucosmini, often to closely related species or species complexes, emphasising the group's strong relationship with myrtaceous host plants.

Host records for 21 reared taxa are presented in this paper. Three of the Tortricidae collected are known polyphages: *Dudua aprobola*, *Epiphyas postvittana* and *Isotenes* cf. *miserana*. The only published records of Tortricidae from *Melaleuca* that we could find are from Common (1990), who indicated that *Bathrotoma constrictana* Meyrick and *E. postvittana* had been reared from unspecified species of *Melaleuca*. Thus the host records presented here are apparently all new and, for 17 of these taxa, appear to be the first published.

Although several other *Strepsicrates* species are known to cause damage to eucalypts in nurseries and plantations (Van der Geest and Evenhuis 1991), this only highlights their potential usefulness in retarding plant growth. The three *Strepsicrates* species we collected are reasonably common and could be promising potential biological control agents, if any prove to be sufficiently host-specific. Worldwide, nine tortricid species have been released as biological control agents for weeds (Julien 1992), including one *Strepsicrates* species. The larvae of the three *Strepsicrates* species we collected bind young tips, or feed on the flowers, of *M. quinquenervia*. Their feeding activities damage new tips, thus restricting branch growth. Young *M. quinquenervia* tips are most prevalent from July to November, when the flush of young growth appears following the end of the winter flowering period. Identifying the adults of these species is frequently difficult and distinguishing the larvae, especially while they are alive, has usually not been possible. This will be a significant impediment to developing these species as biological control agents. "*Bathrotoma*" *quietana* and *Holocola* sp. B are also damaging, but less common and might be considered as biocontrol agents if sufficient numbers can be collected to determine their host range.

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References

BALCIUNAS, J.K., BOWMAN, G.J. and EDWARDS, E.D. 1993 a. Herbivorous insects associated with the paperbark *Melaleuca quinquenervia* and its allies: I. Noctuoidea (Lepidoptera). *Australian Entomologist* **20:** 13-24.

BALCIUNAS, J.K., BURROWS, D.W. and EDWARDS, E.D. 1993 b. Herbivorous insects associated with the paperbark tree *Melaleuca quinquenervia* and its allies: II. Geometridae (Lepidoptera). *Australian Entomologist* **20:** 91-98.

BARLOW, B.A. 1988. Patterns of differentiation in tropical species of *Melaleuca* L. (Myrtaceae). *Proceedings of the Ecological Society of Australia.* **15:** 239-247.

BLAKE, S.T. 1968. A revision of *Melaleuca leucadendron* and its allies (Myrtaceae). *Contributions of the Queensland Herbarium, No.1.* Queensland Herbarium, Department of Primary Industries, Brisbane. 114 pp.

BURROWS, D.W., BALCIUNAS, J.K. and EDWARDS, E.D. 1994. Herbivorous insects associated with the paperbark tree *Melaleuca quinquenervia* and its allies III. Gelechioidea (Lepidoptera). *Australian Entomologist* **21:** 137-142.

COMMON, I.F.B. 1980. Some factors responsible for imbalances in the Australian fauna of Lepidoptera. *Journal of the Lepidopterists' Society* **34:** 286-294.

COMMON, I.F.B. 1990. *Moths of Australia.* Melbourne University Press, Melbourne. xxxii + 535 pp.

JULIEN, M.H. (ed.). 1992. *Biological control of weeds: A world catalogue of agents and their target weeds.* C.A.B. International, United Kingdom. 186 pp.

McQUILLAN, P.B. 1992. A checklist of the Tasmanian tortricid moths (Lepidoptera: Tortricidae) and their host-plant relationships. *Papers and Proceedings of the Royal Society of Tasmania* **126:** 77-89.

MEYRICK, E. 1882. Descriptions of Australian micro-Lepidoptera VI. Tortricina. *Proceedings of the Linnean Society of New South Wales.* **6:** 629-706.

MEYRICK, E. 1911. Revision of Australian Tortricina. *Proceedings of the Linnean Society of New South Wales.* **36:** 224-303.

NIELSEN, E.S. and COMMON, I.F.B. 1991. Lepidoptera (moths and butterflies). Pp 817-915 In: *The Insects of Australia.* Melbourne University Press, Melbourne.

SWAINE, G., IRONSIDE, D.A. and CORCORAN, R.J. 1991. *Insect pests of fruit and vegetables.* 2nd edition. Queensland Department of Primary Industries, Information Series Q191018, Brisbane. 126 pp.

SUCKLING, D.M., ROGERS, D.J. and SHAW, P.W. 1990. Disruption of lightbrown apple moth *Epiphyas postvittana* (Walker) (Lepidoptera: Tortricidae) trapping in Nelson, New Zealand. *Australian Journal of Zoology* **38:** 363-373.

VAN DER GEEST, L.P.S. and EVENHUIS, H.H. (eds.). 1991. *Tortricid Pests: Their Biology, Natural Enemies and Control.* Elsevier, Amsterdam. xviii + 808 pp.

WILSON, C.G., FLANAGAN, G.J. and GILLETT, J.D. 1990. The phytophagous insect fauna of the introduced shrub *Mimosa pigra* in northern Australia and its relevance to biological control. *Environmental Entomology* **19:** 776-784.

RE-EXAMINATION OF THE PARIS MUSEUM *HARPOBITTACUS* GERSTAECKER LISTED BY NAVÁS IN 1910 (MECOPTERA: BITTACIDAE)

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Abstract

The specimens in the Paris Museum listed by Navás (1910) as *Bittacus australis* Klug are newly identified as *Harpobittacus australis* (Klug), *H. nigriceps* (Selys-Longchamps) and *H. ?albatus* Riek.

During the preparation of my recent revision of *Harpobittacus* Gerstaecker (Lambkin 1994), I was not able to re-examine the specimens in the Paris Museum identified by Navás (1910) as *Bittacus australis* Klug. Through the kindness of Jean Legrand of that institution the specimens have now been made available for study. This note records their identity and amends the synonymic lists given in the revision.

The Navás specimens are newly identified as follows:

Harpobittacus australis (Klug): 1 ♂, 'Nouv. Hollande / Guérin-Méneville'; 2 ♂♂, 1 ♀, 'Tasmanie / J. Verreaux 1844'; 1 ♂, 'Victoria / (région alpine) / von Mueller 1890'.

H. nigriceps (Selys-Longchamps): 1 without abdomen, 'Melbourne (Env.) / 210-59'.

H. ?albatus Riek: 1 without abdomen, 'Tasmanie / Verreaux 3-47'. Because it lacks the abdomen, this specimen is not able to be positively identified, but the orange coloration of the lateral margins of the pronotum almost certainly indicates *H. albatus*. This common eastern Australian species (see fig. 48 in Lambkin 1994) has not previously been recorded from Tasmania, and it is probable that the above specimen has been mis-labelled.

The above new information makes necessary the following amendments to the synonymic lists in Lambkin (1994):

p. 772 - under *Harpobittacus australis*:

Delete: '(?) *Bittacus australis*. - Navás, 1910 ...'

Insert under '(partim non) *Bittacus australis* ... ': 'Navás, 1910: 528 (specimen list) (1 without abdomen 'Melbourne (1859)' = *Harpobittacus nigriceps* (Selys-Longchamps), 1 without abdomen 'Tasmanie (J. Verreaux, ... 1847)' = *Harpobittacus ?albatus* Riek)'.

p. 776 - under *Harpobittacus albatus*:

Insert: '(? partim) *Bittacus australis*. - Navás, 1910: 528 (1 without abdomen, 'Tasmanie (J. Verreaux, ... 1847)' probably = *Harpobittacus albatus* Riek).'

p. 799 - under *Harpobittacus nigriceps*:

Insert: '(partim) *Bittacus australis*. - Navás, 1910: 528 (1 without abdomen, 'Melbourne (1859)').'

References

LAMBKIN, K.J. 1994. Revision of the Australian scorpion-fly genus *Harpobittacus* (Mecoptera: Bittacidae). *Invertebrate Taxonomy* **8**: 767-808.

NAVÁS, L. 1910. Catalogue des Panorpides des collections du Muséum. *Bulletin du Muséum National d'Histoire Naturelle Paris* **15**: 526-529.

NOTES ON THE LIFE HISTORY OF *DANAUS GENUTIA ALEXIS* (WATERHOUSE AND LYELL) (LEPIDOPTERA: NYMPHALIDAE: DANAINAE)

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Abstract
Notes are given on the life history of *Danaus genutia alexis* (Waterhouse and Lyell) and the larval food plant identified.

Introduction
The orange tiger, *Danaus genutia alexis* is distributed through north-western Australia to the Northern Territory (Common and Waterhouse 1981). It is the Australian subspecies of a butterfly found as far west as India. No host plant or life history details have been recorded for the Australian subspecies.

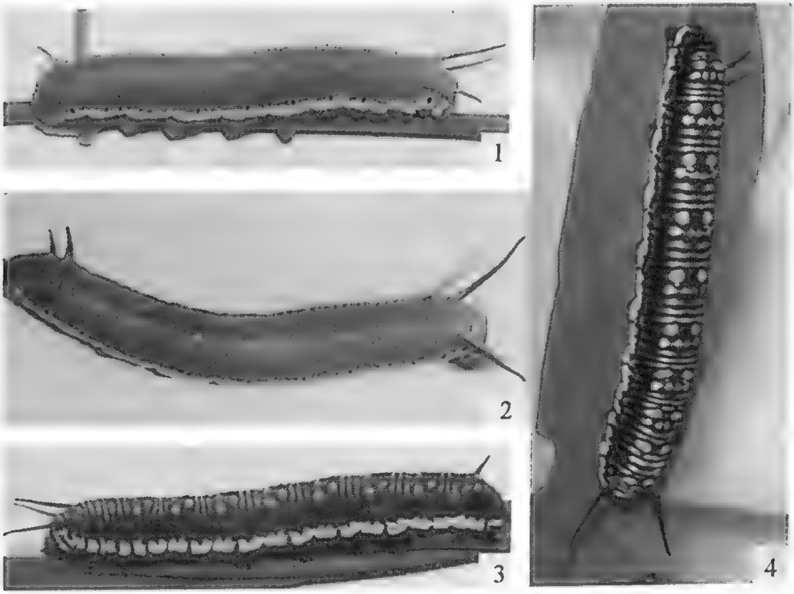
During visits to Kununurra, Western Australia in December 1993 and April 1995, females were observed ovipositing on an asclepiad vine which grows prevalently throughout the Ord River District. Larvae were collected and successfully reared on cuttings of the vine.

Life History
Food Plant. The host plant was identified as *Sarcostemma esculentum* (L.f.) Holm (Family Asclepiadaceae) (Wheeler 1992), a twining perennial vine, leaves shortly petiolate, linear, 37-76 x 3-6.5 mm with pink flowers. The host plant is found in damp habitats and is usually found associated with bulrushes to which it clings for support.

Egg. Cream, taller than it is wide with approximate dimensions of 0.4 x 0.6-0.8 mm, ribbed and flat on apex. The eggs are laid singly on the underside of the mature new growth and on the stems of the host plant. No eggs were noticed on the immature new growth of the host plant. The egg shape is closest in resemblance to that shown in Ackery and Vane-Wright (1984, plate I, fig. 3).

First Instar Larva. Condensed patterning gives larvae a greyish white appearance. On closer examination larval patterning of yellow and white dorsal spotting over a dark brown body colouring can be seen. The majority of larvae examined showed evidence of three pairs of tubercles developing on segments 2, 5 and 11. The tubercles on segment five were the smallest and in several cases were not evident.

Final Instar Larva (Figs 1-4). Larvae collected had extremely variable body colouring and markings, ranging from beige (pale form) to black (dark form). The two most common colours encountered were beige and maroon. Larvae had two or three tubercle pairs on segments 2, 5 and 11, with segment 5 having the smallest pair varying in size from apparently absent to approximately 1.5 mm in length. In some cases the tubercles on segment 5



Figs. 1-4. Final instar larvae of *Danaus genutia alexis*: (1, 2) pale form; (3, 4) dark form.

were small pinkish red dimples. Larvae reached 27-33 mm in length and, just prior to pupation, turned pale green with a conspicuous cream dorsal band on segment 6 where the pupa has a gold-spotted band.

Pale Form (Figs 1, 2): Beige, segments 2-11 with two dorsal yellow spots separated by paler transverse bands, an interrupted cream sub-spiracular band with two yellow spots corresponding to each segment. Tubercles dark brown at tips and pink towards base. Head brown with white markings.

Dark Form (Figs 3, 4): Maroon to black with successive dorsal bands of three white spots, followed by two yellow spots, separated by three narrow white bands on segments 2-11. The central white spot is divided and less conspicuous and there is an interrupted cream sub-spiracular band with two yellow spots corresponding to each segment. Tubercles black at the tips and pinkish red at the base. Head black with white markings.

Pupa. Green or pink with two gold spots on the thorax and eyes; a faint black dorsal line and a raised gold spotted dorsal band on segment 6; approximately 15 mm in length and 8 mm in diameter; similar to that of *Danaus chrysippus petilia* (Stöll) in colouring and shape but the abdomen is stouter and the black dorsal band is greatly reduced.

Discussion

One larva took nine days from hatching to pupation and from the pupae reared, adults took 6-9 days to emerge. Larvae of *D. chrysippus petilia* and *Euploea core corinna* (W.S. Macleay) were also found on the same food plant and successfully reared to adults. Larvae of *D. genutia alexis* orientated themselves head down on the leaves of the food plant, eating it from the tip to the base of the petiole before moving onto another leaf.

The majority of first instar larvae had three pairs of tubercles, with the third and smallest pair on segment 5, often disappearing during the later instars, occasionally persisting to the final instar. All larvae reared in captivity from egg or early instar took on the dark form.

Pupation occurred on the stems of the host plant or on the bulrushes adjacent to it. Adults fed at flowers early in the morning before retreating to the cooler environs of the swamp during the heat of the day. During both visits, adults and the host plant were plentiful, with the host plant totally covering the tops of trees within the swamp in December 1993.

In recent times adults have been collected in the Northern Territory at Oolloo Crossing on the Daly River (14°04'S, 131°15'E) and at Fog Bay (12°49'S, 130°22'E). Adults use the Daly River as a flight path and have been taken feeding at flowers on the river bank during the dry season. At the Fog Bay site adults were caught flying through mangrove swamps behind coastal sand dunes. At both locations adults were scarce, suggesting that breeding may not be taking place nearby. Northern Territory Herbarium records show that the food plant is known to occur on the Peron Islands (at the mouth of the Daly River) and the Milingimbi Flood Plain. Further exploration of the Daly River environs may establish breeding grounds for *D. genutia alexis* on this plant.

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References

ACKERY, P.R. and VANE-WRIGHT, R.I. 1984. *Milkweed butterflies*. Pp ix + 425. British Museum (Natural History), London.

COMMON, I.F.B. and WATERHOUSE, D.F. 1981. *Butterflies of Australia*. Pp. xiv + 682. Angus and Robertson, Sydney.

WHEELER, J.R. (Editor). 1992. *Flora of the Kimberly Region.*. Pp 1327. Department of Conservation and Land Management, Perth.

AN ACCUMULATIVE BIBLIOGRAPHY OF AUSTRALIAN ENTOMOLOGY
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FALKINGHAM, C.

1995 Those magical, mystical creations - galls. *Victorian Nat.* **112:** 178-179.

MARTIN, A.

1995 The wasp and the spider. *Victorian Nat.* **112:** 177.

SMITHERS, C.N.

1995 The first record of *Tirumala hamata hamata* (W.S. Macleay) (Lepidoptera: Nymphalidae), the blue tiger butterfly on Norfolk Island. *Norfolk Nature Notes* **11:** 395-396.

TSACAS, L. and ARTIGAS, J.N.

1994 Le genre *Cophinopoda* Hull, 1958 (Diptera: Asilidae) à répartition subcosmopolite inhabituelle. *Annls Soc. ent. Fr.* **30:** 447-479.

WALLMAN, J.F.

1993 First South Australian record of the carrion-breeding blowfly *Calliphora nigrithorax* Malloch (Diptera: Calliphoridae). *Trans. R. Soc. S. Aust.* **117:** 193.

WANG, Q.

1993 A revision of *Atesta* Pascoe (Coleoptera: Cerambycidae: Phoracanthini) from Australia, with descriptions of eighteen new species. *Invert. Taxon.* **7:** 961-1024.

1993 *Paratesta* gen. n. (Coleoptera: Cerambycidae) from Australia. *J. Aust. ent. Soc.* **32:** 369-377.

1995 A new genus, *Steata* (Coleoptera: Cerambycidae), from Australia. *J. Aust. ent. Soc.* **34:** 211-214.

WANG, Q., THORNTON, I.W.B. and NEW, T.R.

1994 Systematics and biogeography of the Australian-New Guinean genus *Thoris* Pascoe (Coleoptera: Cerambycidae: Phoracanthini). *Invert.. Taxon.* **8:** 839-860.

WATSON, J.A.L. and ABBEY, H.M.

1993 *Atlas of Australian termites.* ix + 155 pp. C.S.I.R.O.: Canberra.

WEBB, G.A.

1993 Larval host plants of some Australian Cerambycidae. *Vict. Ent.* **23:** 72-77.

1993 Plant associations of some Australian jewel beetles (Coleoptera: Buprestidae: Agrilinae). *Victorian Nat.* **110:** 160-162.

1994 Sleeping aggregation of insects on *Leptospermum myrtifolium* Sieber ex DC near Bombala, New South Wales. *Vict. Ent.* **24:** 60-62.

1994 The insect fauna inhabiting the wood of some *Acacia* spp. in south-eastern Australia. *Vict. Ent.* **24:** 80-92.

1994 A new larval host for *Stenoderus suturalis* (Olivier) (Coleoptera: Cerambycidae) with a note on use of Asteraceae by Cerambycidae. *Vict. Ent.* **24:** 113-116.

1994 Some insects found on blackthorn, *Bursaria spinosa* Cav. (Pittosporaceae) flowers at Bombala, New South Wales. *Victorian Nat.* **111:** 238-240.

WEBSTER, A.

1993 *Action statement No. 39. Eltham copper butterfly Paralucia pyrodiscus lucida.* Department of Conservation and Natural Resources: Melbourne.

WEINSTEIN, P.

1994 Behavioural ecology of tropical cave cockroaches: preliminary field studies with evolutionary implications. *J. Aust. ent. Soc.* 33: 367-370.

1994 Insects in psychiatry. *Cultural Ent. Digest* **2:** 10-14.

WEINSTEIN, P. and EDWARDS, E.D.

1994 Troglophilic moths in Australia: first record of a self-sustaining population. *J. Aust. ent. Soc.* **33:** 377-379.

WEINSTEIN, P. and SLANEY, D.

1995 Invertebrate faunal survey of Rope Ladder Cave, northern Queensland: a comparative study of sampling methods. *J. Aust. ent. Soc.* **34:** 233-236.

WEIR, T.A.

1993 Results for carabid and scarabaeoid beetles. Pp. 191-199 *in* Naumman, I.D., Edwards, E.D., Weir, T.A. and Rentz, D.A., Insects of the Heathlands Area, Cape York Peninsula, Queensland. Pp. 173-203 in *Cape York Peninsula Scientific Expedition Wet Season 1992 Report.* Vol. 2. Royal Geographic Society of Queensland Inc.: Fortitude Valley, Qld.

WELLS, A. and CARTWRIGHT, D.I.

1993 Females and immatures of the Australian caddisfly *Hyalopsyche disjuncta* Neboiss (Trichoptera), and a new family placement. *Trans. R. Soc. S. Aust.* **117:** 191-192.

WELLS, A. and CARTWRIGHT, D.I.

1993 Trichoptera, Ephemeroptera, Plecoptera and Odonata of the Jardine River area, Cape York Peninsula, northern Queensland. Pp. 221-230 in *Cape York Peninsula Scientific Expedition Wet Season 1992 Report.* Vol. 2. Royal Geographic Society of Queensland Inc.: Fortitude Valley, Qld.

WERREN, G.L. and TRENERRY, M.P.

1993 Size and diet of *Bufo marinus* in rainforest of northeastern Queensland. *Mem. Qd Mus.* **34:** 240.

WESTCOTT, A.

1993 Lepidopterism in Australia - hairy caterpillars and you. Summary of a talk presented to the Society Sept 1, 1993. *Circ. ent. Soc. N.S.W.* **432:** 26-28.

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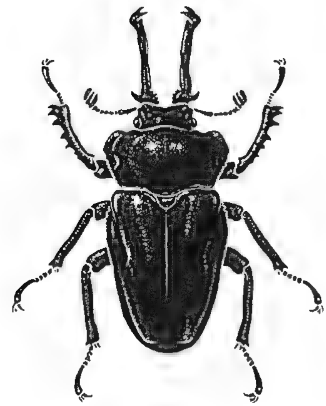

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